Guide to Wetland Ecosystems of the Very Dry Montane Interior Douglas-fir Subzone Eastern Fraser Plateau Variant (IDFb2) in the Cariboo Forest Region, British Columbia

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Guide to Wetland Ecosystems of the Very Dry Montane Interior Douglas-fir Subzone Eastern Fraser Plateau Variant (IDFb2) in the Cariboo Forest Region, British Columbia

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1 INTRODUCTION

Non-forested wetlands are common on the plateau landscapes of the Cariboo Forest Region. They are an important resource, providing habitat for waterfowl and wildlife, range for domestic livestock, and hay for agriculture. Through management, their value for wildlife, agriculture, and range can be enhanced. However, understanding of wetland ecosystem characteristics and processes in the Cariboo Forest Region has not kept pace with the increasing pressures for wetland use. As a result, a sound ecological basis has not always been available for selecting the most appropriate management option or for assisting the resolution of potential use conflicts.

The Ministry of Forests is conducting ecological studies of wetlands in the Cariboo Forest Region as part of a provincial ecological classification program. The objective of these studies is to develop an ecosystem classification and a set of management interpretations for wetlands which can serve as a framework and guide for sound management decisions.

The wetland unit classified in these studies is the ecosystem, as defined by the Ministry of Forests ecological classification program (Pojar 1983). For practical purposes the ecosystem is characterized as an area of relatively uniform vegetation, soils and other physical site characteristics. It may encompass an entire wetland area or be only a small portion of a wetland. The approach used to classify wetlands is compatible, in part, with the hierarchical approach used by Runka and Lewis (1981). Specifically, the criteria used by them to distinguish wetland units at the class level are used here to classify ecosystem units. Below the class level, however, the ecosystem classification relies heavily on vegetation to define ecosystem units. The physical and chemical criteria used by Runka and Lewis to define units below the class level are used whenever possible to characterize and assist in the classification of ecosystems.

The objectives of this guide are (1) to present a classification of wetland ecosystem units of the Eastern Fraser Plateau Variant of the Very Dry Montane Interior Douglas fir (IDFb2) biogeoclimatic subzone; and (2) to summarize range and wildlife habitat management interpretations for each of the ecosystem units.

For the purposes of this classification, descriptive data on vegetation, soils, and water regime were collected from 91 wetland ecosystems. These detailed data were supported by extensive reconnaissance observations.

2 STUDY AREA

2.1 Location

Location of the Very Dry Montane Interior Douglas-fir Biogeoclimatic Subzone, Eastern Fraser Plateau Variant (IDFb2), within the Cariboo Forest Region, is shown in Figure 1. The IDFb2 biogeoclimatic variant occurs primarily in the Cariboo Forest Region; a very small portion also occurs within the northern Kamloops Forest Region. The IDFb2 occurs from approximately 51° to 52°30' N latitude and 121° to 123° W longitude. Elevations are typically 750-1000 m a.s.l. in the north and 900-1150 m a.s.l. in the south.

The study area, from which detailed data for this wetland classification were collected, lies on the plateau between the San Jose and Fraser rivers in the central and southern portion of the IDFb2 (Figure 1). The study area is bordered on the north by Lac La Hache, the south by the Marble Range, the east by Highway 97 and the west by approximately 122° W longitude. This portion of the IDFb2 was selected for intensive study because it includes a concentration of wetlands and is an area where wetlands are intensively used.

2.2 Climate

Climate of the IDFb2 is characterized by warm, dry summers and very cool, light snowfall winters. Mean annual precipitation (15 stations) is 434 mm; mean May to September precipitation is 214 mm. Snow generally covers the ground from November until April, with maximum depths in the order of 500 mm. The climate is distinctly continental with a wide range of mean monthly temperatures. Mean temperature of the warmest month (July) is 15.1°C, while mean temperature of the coldest month (January) is -10.6°C. Five months have mean temperatures less than 0°C and about 4 have mean temperatures greater than 10°C. The mean annual temperature is 3.5°C.

2.3 Physiography and Geology

The IDFb2 lies primarily on the Fraser Plateau (Holland 1976). Only small portions along the Fraser and San Jose rivers are within the Fraser Basin. The Fraser Plateau has a flat to gently rolling surface with large areas of relatively undissected upland. Few prominent relief features are present. Surface drainage patterns are generally not well developed and as a result, small ponds and wetland ecosystems are numerous.

The underlying bedrock of the plateau is primarily flat-lying or gently dipping olivine basalts and andesites (Campbell and Tipper 1971). These originated from lava flows extruded during the late Miocene. The olivine basalts have a relatively high component of base-rich minerals.

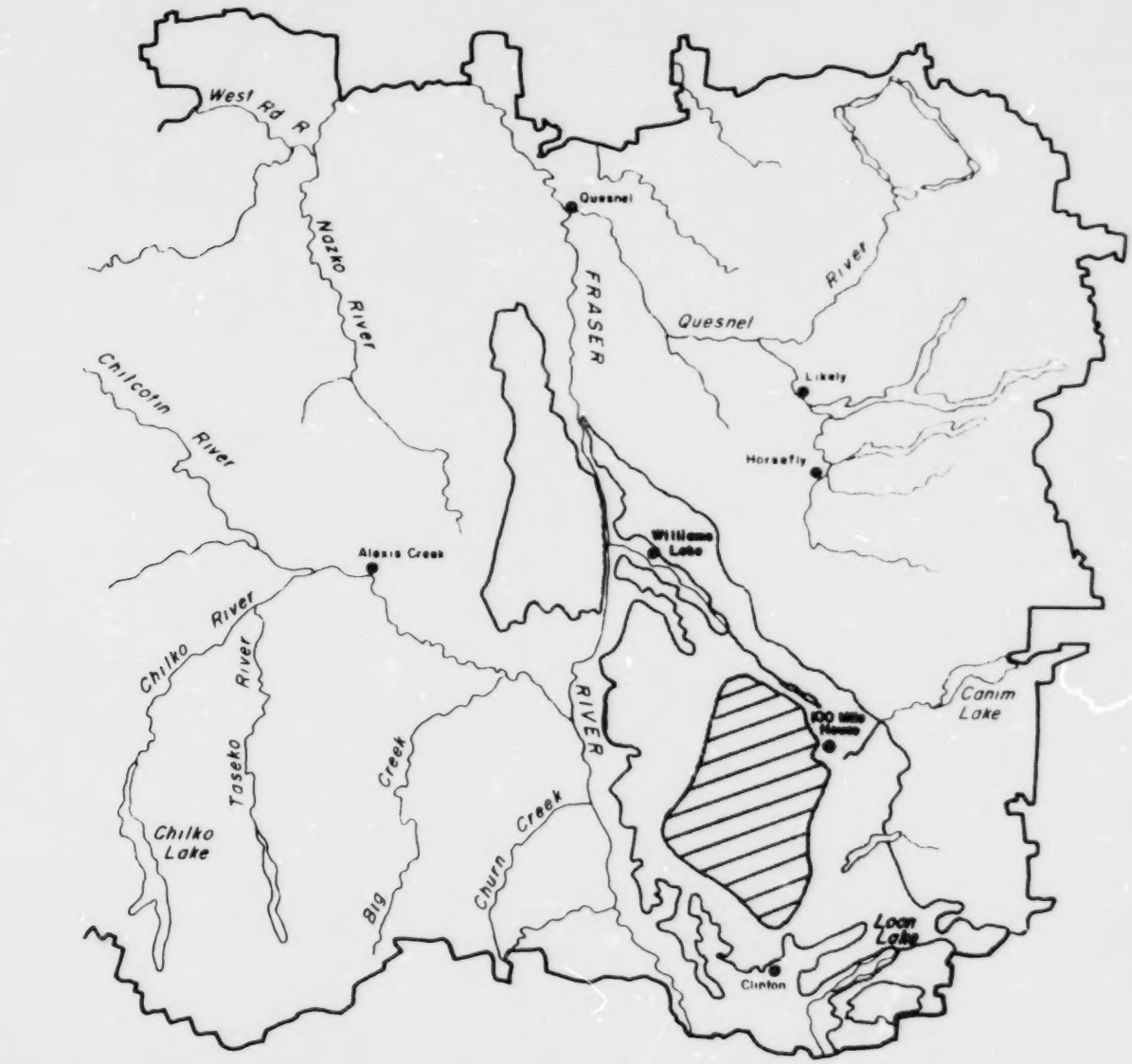

Figure 1 : Location of the study area within the Interior Douglas Fir (b) Subzone, Eastern Fraser Plateau Variant (IDFb2) in the Eastern Portion of the Cariboo Forest Region

Most bedrock surfaces of the Fraser Plateau are covered by a blanket of morainal materials (glacial till), deposited during the Fraser glaciation between 20 000 and 10 000 years ago. These materials are mostly loamy in texture and are mineralogically similar to the underlying bedrock. They generally have a high base status. Other less extensive surficial materials include: 1) glaciofluvial sands and gravels deposited by glacial meltwaters, 2) localized lacustrine materials deposited in small glacial and post-glacial ponds, and 3) recent fluvial silts and clays deposited by slow moving waters adjacent to present streams. Organic materials, primarily sedge peat, have accumulated in local, poorly drained depressions, often over lacustrine sediments. Surficial materials of wetland ecosystems are primarily organic accumulations, lacustrine sediments, and, to a lesser extent, glacial till.

Groundwater, and thus wetland ecosystems in the IDFb2, is typically base-rich with high concentrations of calcium carbonate. This is a result of the high base status of surficial materials, the relatively dry climate, and the general lack of well-developed drainage patterns.

2.4 Soils

Soils of the study area are described by Valentine and Schori (1980) and Coupe´ and Yee.[1] The dominant upland soils of the IDFb2 are Orthic Gray Luvisols formed on loamy morainal parent materials derived from basic volcanic rocks. These soils have a high base status and frequently include free carbonates in lower horizons.

Wetland ecosystems in the IDFb2 occur on both mineral and organic soils. Mineral soils occur in meadows, marshes, and shrub-carrs, and are developed primarily on lacustrine or morainal parent materials with a silt loam to silty clay loam texture. Alkaline solonetz soils occur in some saline meadows, especially those on lacustrine materials which become dry by mid-season.

Organic soils occur in fens and swamps. They are most commonly mesisols and less often fibrisols and humisols (Central Interior Forage Extension Committee, 1981). They are commonly neutral to basic in reaction and often contain precipitated calcium carbonate or calcareous mollusc and gastropod shells (marl). Organic materials are primarily sedge-derived peats; bog soils developed on sphagnum-derived peat are very uncommon in the IDFb2.

Latitudinal differences within soils of the IDFb2 have been noted by Valentine and Schori (1980). The southern third of the IDFb2 includes relatively few organic soils and a greater representation of saline soils compared to northern areas. In addition, carbonates are leached to shallower depths and leaching of clay is less pronounced in the south.

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[1] Coupe´, R. and A. Yee (editors). 1982. Identification and interpretation of ecosystems of the Cariboo Forest Region. B.C. Min. For., Cariboo For. Region, Williams Lake, B.C. Unpublished authors' draft.

2.5 Vegetation

Upland vegetation of the IDFb2 is predominantly coniferous forests of Douglas-fir and lodgepole pine. Douglas-fir is considered the climax tree species but the presence of extensive lodgepole pine forests has been maintained by wildfires. In the IDFb2 forests, Coupe´ and Yee identify and describe eight upland and two forested wetland ecosystem associations, each with distinctive vegetation.[2] On well drained sites with medium textured soils and medium moisture and nutrient regimes, the forest undergrowth consists of a sparse shrub layer and a well-developed herbaceous layer dominated by pinegrass (Calamagrostis rubescens). Forested wetland ecosystems are included in a horsetail - leafy moss (Equisetum - Mnium) association and a Labrador tea - sphagnum moss (Ledum groenlandicum - Sphagnum) association, both with forest canopies dominated by hybrid white spruce (Picea glauca x engelmannii).

Non-forested wetlands are abundant in the IDFb2. Cattail (Typha latifolia) and great bulrush (Scirpus lacustris) marshes[3] occur in shallow depressions and around the perimeter of open water, especially in southern portions of the study area. Sedge fens with vegetation dominated by water sedge (Carex aquatilis), beaked sedge (C. rostrata), or slender sedge (C. lasiocarpa) are very common and often cover large wetland tracts. Many of these fens include a tall or low shrub layer of willows (Salix spp) and scrub birch (Betula glandulosa). Scrub birch dominated shrub-carrs occur at the dry periphery of many fens. Saline meadows are relatively dry wetlands that commonly occur in the transition from wetland to upland, especially in southern portions of the study area. The vegetation is usually dominated by grasses such as alkali saltgrass (Distichlis stricta), Nuttall's alkaligrass (Puccinellia nuttalliana) and foxtail barley (Hordeum jubatum). Other wetland types of the IDFb2 include tall willow swamps that follow the course of small streams and diffuse drainage channels. Bogs are very uncommon in the IDFb2.

The IDFb2 lies at the northern limits of the Intermountain Prairie wetland region of Canada (Zoltai 1980), extending slightly into the Mid-Boreal region. Characteristic wetlands of the first region are saline and fresh water marshes, while bogs and fens characterize the second, more northerly region (Zoltai 1980). Evidence of the transition between these two regions can be found in the IDFb2 wetlands. Saline mineral meadows are most common in southern portions of the area, while fens dominate the northern portions of the area.[4] This corresponds to the soil differences noted by Valentine and Schori (1980).

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2 Ibid

3 Wetland classes (shallow open water, marsh, fen, bog, swamp, shrub-carr, and meadow) are defined in Section 3.2.1.

4 Dobyns, E.V. and S. Thompson. 1982. Preliminary wetland associations of the Interior Douglas-fir, Wet Subzone (IDFb). B.C. Min. For., Cariboo Forest Region, Range Section, Williams Lake, B.C. Unpublished draft.

3 USE OF THE GUIDE

3.1 Definition of Wetlands

The term "wetland" is a broad generalization. It is used by most people to designate tracts of land where soils are inundated or saturated with water for a sufficient period of the growing season to promote a distinctive type of vegetation and soil development. In contrast to uplands where soils are saturated for no more than brief periods following snowmelt or heavy rainfall, wetlands are saturated with water for a sufficient period of the growing season that water saturation becomes a dominant factor in determining the course of ecosystem development.

Although most people have a concept of wetlands, a precise definition, which can be strictly applied to separate wetlands from uplands, is not easily developed. In large part this has occurred because wetlands are highly variable and most often pass into uplands through gradual transitions. However, nearly all definitions emphasize saturation with water, and thus the National Wetlands Working Group of Canada defines wetlands as "lands having the water table at, near, or above the land surface or which are saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophilic vegetation and various kinds of biological activity which are adapted to the wet environment" (Tarnocai 1980). In the Cariboo Resource Management Region a somewhat broader definition of wetlands is provided by Runka and Lewis (1981): "lands that are wet enough or inundated frequently enough to develop and support a distinctive natural vegetation cover that is in strong contrast to the adjacent matrix of better drained lands". The Runka and Lewis definition is adopted for purposes of this report. It is somewhat broader in scope than that of the National Wetland Working Group definition, as it does not require hydric soils. It thus encompasses certain ecosystems of the Cariboo Forest Region that are rarely inundated and are saturated just long enough to promote a distinctive vegetation. By late growing season, the water table may be well below the soil surface (>75 cm) in these wetlands. These ecosystems are included in the meadow and shrub-carr classes (Runka and Lewis 1981). Wetlands are also defined here as having 2 m or less of standing water to separate them from lakes that have deeper water.

Wetlands may be either forested or non-forested. The classification presented in this report includes only non-forested wetlands, that is, those in which the undisturbed vegetation has less than 5% cover of trees more than 10 m tall. Forested wetland ecosystem associations are described by Coupé and Yee.[5]

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[5] Coupé and Yee, 1982.

3.2 Classification of wetlands

3.2.1 Wetland classes

Seven wetland classes (high level groupings of ecosystem units) are recognized for the Cariboo Resource Management Region by Runka and Lewis (1981): shallow open water, marsh, swamp, fen, bog, shrub-carr, and meadow. All but the last two are also included in the National Wetland Classification (Zoltai et al.1975; Tarnocai 1980). These seven classes are adopted in this report to group ecosystem units. They are defined by Runka and Lewis (1981) as follows:

Shallow Open Water: Shallow Open Water is a wetland that is comprised of permanent shallow standing water, and lacks extensive emergent plant cover. Shallow refers to waters with an average mid-growing season depth of less than 2 m. "Permanent" is meant to infer that a water surface is maintained regardless of normally expected yearly weather fluctuations, but it could be diminished or even disappear in exceptionally dry years. Emergent plants -- that is plants rooted in bottom materials and extending upwards above the water surface -- may have up to 10 % cover.

Marsh: Marshes are wetlands that are permanently or seasonally inundated and that support an extensive cover of emergent, non-woody vegetation rooted in a mineral-rich substrate. The water level of marshes varies seasonally and from marsh to marsh, from a maximum depth of around 2 m, down to 0 m. In marshes that dry by late summer, saturation persists near the surface, except for short periods in drier years. Emergent plants have a cover in excess of 10%. The substrate of marshes is dominantly mineral, but may include considerable accumulations of organic materials, derived primarily from marsh vegetation.

Fen: Fens are wetlands with *in situ* accumulations of well to poorly decomposed non-sphagnic peats. Fens have accumulations of peat as little as 15 cm thick, although most fens have in excess of 40 cm of peat accumulation. The build-up of peat in fens takes place in waters that derive primarily from groundwater and runoff from adjacent mineral uplands. As a result, fens are generally less acid and more mineral-rich than are bogs. Fen vegetation is dominated by a variable cover of sedges, shrubs, and mosses. Hummock-forming sphagnum mosses are absent, except in fens that are transitional to bogs.

Bog: Bogs are wetlands comprised of *in situ* accumulations of poorly to moderately decomposed sphagnum-derived peats. Bog surfaces are elevated above the groundwater table largely as a result of the upward growth of sphagnum mosses. Consequently, the major source of water in the upper peat is precipitation, which is a relatively poor source of dissolved ions. As a result, the upper peat layers of bogs are strongly acid and low in mineral materials. Bog vegetation includes a dominant moss cover of sphagnum mosses with variable components of low ericaceous shrubs, trees, cottongrass (*Eriophorum* spp.), and lichens.

Swamp: Swamps are tree- or tall shrub-dominated wetlands that are characterized by periodic flooding and nearly permanent subsurface waterflow through various mixtures of mineral sediments and organic materials. Swamps are rich in minerals and nutrients due to their riverine hydrotopographic position, which ensures regular import of fresh sediments and/or dissolved constituents to the site. The substrate of swamps ranges from mineral material with surface organic enrichment, to organic accumulations of 50 cm or more.

Shrub-carr: Shrub-carrs are shrub-dominated wetlands developed on mineral materials that are periodically saturated but rarely inundated. Shrub-carrs occur in depressional positions in the landscape and receive most of their water from runoff and seepage from the surrounding basin slopes. After seasonal saturation following snowmelt, the water table drops below the rooting zone during the growing season. The substrate is dominantly mineral but thin accumulations of organic matter of up to 15 cm overlie the mineral soil.

Meadow: Meadows are herbaceous wetlands developed on mineral materials that are periodically saturated but rarely inundated. Meadows receive most of their water from runoff and seepage from surrounding areas. After seasonal saturation following snowmelt, the water table drops below the rooting zone during the growing season. The vegetation of meadows has an overall grassy appearance and is comprised of various mixtures of grasses, low sedges, rushes, and forbs. Organic accumulations are less than 15 cm. Meadows are best distinguished from adjacent uplands that have natural grassland plant communities, by sharp differences in vegetation.

3.2.2 Ecosystem classification concepts

The wetland classification presented here uses a site specific ecosystem approach, similar in principle to that used in other B.C. Forest Service ecosystem classifications. In this approach, the landscape unit being classified is the ecosystem, which may be thought of as an area of uniform soils, vegetation, and ecological processes. It is a natural, functional ecological system that has geographic bounds defined by the biological organisms and their physical/chemical environment. Since ecosystems have relatively uniform properties and processes, they are also expected to have relatively uniform responses to management practices.

The size of individual wetland ecosystems is variable, determined only by the extent of relatively uniform conditions of vegetation and soils. An individual ecosystem may comprise an entire wetland area or be only a very small portion of it.

Ecosystems having similar properties occur repeatedly and predictably over the landscape, wherever similar environments are present. Ecosystem classification groups these similar ecosystems into classes for which generalizations can be made regarding their properties and responses to management.

In the Ministry of Forests and Lands approach to ecosystem classification, the first level of classification is the biogeoclimatic level, which deals with the occurrence of ecosystems in relation to macroclimate. At this level, geographic areas of relatively homogeneous macroclimate are identified and mapped. The basic units of classification at this level are biogeoclimatic subzones and, if present, variants. In practice, these units are most often recognized and mapped on the basis of the vegetation and soils that occur on "zonal" sites. These upland sites have medium moisture, nutrient, and heat regimes and thus best reflect the climate of the area.

The second, or ecosystem level of classification deals with the classification and characterization of individual ecosystems that are distributed over the landscape in relation to local site factors. This is the level of classification presented here for wetlands of the IDFb2. The basic unit of classification at this level is the ecosystem association[1]. It is a grouping of all ecosystems that potentially support the same vegetation association at climax.

Vegetation is given strong emphasis in defining ecosystem associations because it can be used as an indicator of the physical, chemical, and biological properties of the ecosystem. It is also an integrator of the effects of these properties on plant species. Thus, for example, saline wetland ecosystem associations are not identified in this approach by water salinity levels *per se*, but

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[1] The Ministry of Forests and Lands is currently refining concepts and terms used in the Biogeoclimatic Ecosystem Classification (BEC) system (Pojar *et al.* 1986). Under this refinement, the site series is largely equivalent to the ecosystem association. We continue to use ecosystem association in this report since the new approach is not yet finalized.

rather by a type of vegetation that is an indicator of saline conditions. Vegetation "at climax" is used to define the ecosystem association, since "climax" vegetation is generally considered to be a more reliable indicator of environment than is early successional vegetation. ("Climax" is used here to mean vegetation that is successionally stable, or in which succession is too slow to produce significant changes in vegetation structure or composition within a human lifetime.)

Ecosystem associations can be variously combined to meet specific user needs. These needs may include description of higher taxonomic levels or documentation and mapping of wetland ecosystem sequences within a wetland area.

3.3 Identification of Ecosystems

To apply the ecosystem classification in this guide it is necessary to be able to identify wetland ecosystem units in the field. For this purpose, a key to ecosystem units is provided in Section 4.1. A basic familiarity with the major characteristics of wetland soils, hydrology, and vegetation is necessary to use this key. Whenever possible, the key uses features that are readily observable in the field. Key features include major soil characteristics, vegetation structure, dominant plant species, and hydrological regime. It is emphasized that the key is a guide to identification. In some cases an interpretation of the intent of the key, based on familiarity with wetland ecosystems, would improve the ability to correctly identify ecosystem units. This is especially true for ecosystems transitional between the modal concepts defined here. The purpose of the following discussion is to provide some background definitions of wetland ecosystem characteristics used to identify ecosystems in this report.

To identify a wetland ecosystem in the field, the following steps should be followed:

1. Record major features that are used to identify and characterize wetland ecosystems. These include depth and duration of surface water, presence of subsurface or surface water flow, depth and decomposition of soil organic materials, texture of mineral materials, depth below surface to free water, and identification and percent cover of dominant plant species.

2. Use the dichotomous key as a guide to identification of the ecosystem unit. The key is based on making a series of choices between two alternatives until the name of the ecosystem unit is reached. It should be noted that the classification is based on relatively undisturbed wetlands and, as a result, some difficulty in using the key to identify highly disturbed or heavily managed wetlands may be encountered .

3. Compare the ecosystem under consideration with that of the appropriate description in Section 4.2 to verify that the correct identification has been made. As this classification is preliminary, some ecosystems that cannot be classified may be encountered .

The principal characteristics used to identify wetland ecosystems in the key fall under three broad headings: moisture-aeration regime, type of substrate, and vegetation. Most authors of wetland studies also include nutrient-pH regime as an important character in determining distribution of wetland ecosystems (Jeglum et al. 1974; Runka and Lewis 1981). However since available nutrients are not readily quantified in the field, nutrient regime is largely avoided in this key to wetland ecosystem units. Significant nutrient regime differences among ecosystem units are interpreted largely through vegetation.

The relative moisture-aeration regime is a major determinant of wetland ecosystem distribution. For purposes of this wetland classification, it can be indicated by duration of standing water at or above the surface, depth below surface to water table and presence of surface or subsurface flowing water. Standing water ,at or above the surface limits soil aeration, retards soil biological activities, and restricts the growth of many plant species. On the other hand, as the water table drops below the surface, aeration is improved but plant water stress may limit the occurrence of some wetland species. In addition, soil organic matter decomposition is usually enhanced. In contrast to standing water, flowing water is relatively oxygenated and enriched in nutrients. As a result, soils saturated by flowing water generally support a vegetation distinct from that in areas of standing water.

For purposes of describing the relative moisture-aeration regime, ecosystems are described as permanently or seasonally inundated. Permanently inundated sites are covered by standing water until at least September in all but the driest years. Seasonally inundated sites usually do not have standing water after mid-August; standing water often disappears much earlier. Some wetland ecosystems such as meadows and shrub-carrs are only briefly, if ever, inundated. Among ecosystems that are seasonally inundated, variations in standing water duration may be broadly described by dividing the growing season into three periods and indicating the presence and average depth of water in these periods:

early season - prior to mid-July
mid season - mid-July to mid-August
late season - mid-August and later

If standing water is absent at the time of recording, the depth to free water (water table) should be recorded.

The presence of flowing water below the surface is often indicated by small pools and discontinuous channels on the surface. Surface water flow is readily apparent.

The principal substrate characteristic used to identify wetland ecosystem units in the key is whether the substrate is organic or mineral and, if organic, the depth of organic accumulation. For purposes of this guide, organic substrates are those that have a surface organic layer (30% or more organic matter by dry weight) usually greater than 40 cm, but as little as 15 cm thick. Mineral substrates have a thinner, or no, organic layer. Mineral-rich organic substrates, present in some wetland ecosystems, are organic substrates that also have a significant component of mineral materials.

Other substrate characteristics used to characterize wetland ecosystems in this guide include degree of organic matter decomposition, texture of mineral substrates, and soil classification.

Identification of wetland ecosystem units in this classification requires some familiarity with wetland plant species and vegetation. To assist in the recognition of plant species, a guide to all species mentioned in this classification is presented in Appendix 1.

3.4 Wetland Ecosystem Description Format

A standard format has been used to describe each wetland ecosystem unit. The types of information included in this format are described in this section. For reference, refer to any of the ecosystem unit descriptions included in Section 4.2.

1. Ecosystem Association Code Name: appears on upper left corner of first page.

   e.g.

   IDFb2/W5

Biogeoclimatic Zone, Subzone and Variant	Ecosystem Association ("W" used to indicate non-forested wetland)

2. Ecosystem Association Name: Ecosystem associations are named according to characteristic plant species. Standard common names for species(Meidinger 1987) are given preference, followed by the corresponding scientific names in brackets. The name also identifies the wetland class (fen, swamp, etc.) of the association. Associations transitional between classes are named accordingly. For example, a marsh association with many fen characteristics (such as deep organic accumulations) is described as a fen-marsh.

3. Moisture Regime: The predominant ecological moisture regime classes of the association are listed. The moisture regime classification used by the Ministry of Forests in the Cariboo Region includes 10 classes (very xeric to hydric), which are defined in Coupe´ and Yee.[6] Wetlands occur on four of these classes (subhygric, hygric, subhydric, hydric).

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[6] Coupe´ and Yee, 1982.

4. Surface Water: indicates the duration and mid to late season depths of water over the soil surface. Duration is given as seasonal (disappearing before late growing season) or permanent.

5. Subsurface Free Water: indicates range of depths below surface to free water (water table) during mid to late growing season.

6. Hygrotopographic Character: Hygrotopographic character of a wetland reflects local topographic position and the character of the watershed from which the wetland receives surface or ground water. It indicates management opportunities for flow control (Runka and Lewis 1981). Hygrotopographic character descriptors are defined by Runka and Lewis (1981) as:

palustrine hydrotopographic character - wetlands occupy landscape depressions in which input of surface and ground water flow balances output due to evapotranspiration and outflow.

lacustrine hydrotopographic character - wetlands occur in landscape depressions adjacent to permanent fresh open water more than 2 m deep; the wetland water regime is largely determined by lake hydrology.

riverine hydrotopographic character - wetlands are intimately associated with flowing waters in well defined channels; wetland water regime is largely determined by hydrology of the river or stream.

Palustrine and lacustrine can be subdivided into basin types:

closed basin - wetland receives water only from surrounding upland and has no overflow or outlet.

overflow basin - wetland receives water only from surrounding upland but will overflow through outlet when excess water is received.

linked basin - wetland receives water from both the surrounding upland and from overflow basins or other linked basins higher in the watershed; wetland will overflow when excess water is received.

terminal basin - wetland receives water from both the surrounding upland and from overflow basins or other linked basins but will itself not overflow.

lowland - basin types around the wetland are not definable due to extensive subdued topography.

Riverine hydrotopographic character can be subdivided into floodplain riverine and stream riverine:

floodplain - wetland bordering a river and in part built up from sediments deposited during flooding; wetland substrate influenced by sediments during floods.

stream - wetland bordering a stream that is not building a floodplain of transported sediments; wetland substrate is little influenced by sediment deposition since the stream carries only a small volume of sediment during flood.

7. Slope Position/Shape: Slope position classes are described by Walmsley et al. (1980): crest, upper, mid, level, lower, toe, and depression. Wetlands occur primarily in the last three classes. Shape of the slope is given as concave, straight, or convex.

8. Occurrence/Size: Subjective estimates of the frequency of occurrence and typical size of ecosystems in the association are given as broad aids to managers. Occurrence is listed as:

   very common - a predominant or most frequent association of the subzone or variant.

   common - occurs frequently, and representative ecosystems are readily found but it is not a predominant association of the subzone.

   uncommon - occurs infrequently in the subzone or variant.

   Size is described as:

   large - continuous ecosystems typically cover 8 ha or more and often dominate the wetland tracts in which they occur.

   medium - continuous ecosystems typically cover one to 8 ha or occur as long narrow bands along drainage courses.

   small - ecosystems typically occur as small ($<$ 1 ha) islands or narrow bands in wetlands dominated by other associations.

9. Parent Material: soil parent material is described according to origin, surface expression, and texture.

   Origin is described as:

   organic - accumulations of partially to well-decomposed plant remains. These materials contain 30% or more by dry weight of organic matter.

   lacustrine - stratified mineral materials that were deposited on bottoms of lakes or ponds. They are often silty or clayey.

morainal - nonstratified mineral materials deposited directly by glaciers and consisting of a heterogeneous mixture of particle sizes.

fluvial - mineral and usually stratified materials deposited by moving water. Textures may be silty, loamy, or sandy depending on the velocity of the water from which they were deposited.

Surface expression is described for purposes of this report as:

veneer - deposits too thin to mask minor irregularities of the underlying surface; generally less than 1 m thick.

blanket - deposits sufficiently thick to mask minor irregularities of underlying materials but still conforming to general underlying topography.

Texture of mineral materials is described as:

clayey - predominant textural classes are clay, silty clay, sandy clay or clay loam.

silty - predominant textural classes are silt and silt loam.

loamy - textural classes are loam and sandy loam.

sandy - textural classes are loamy sand and sand.

Soil textural classes are defined by Canada Soil Survey Committee (1978a).

10. Organic Depth: indicates depth of accumulated organic materials over surface of mineral soil.

Organic Decomposition: indicates predominant degree of decomposition of accumulated organic materials within rooting zone as:

poor - contains large amounts of well-preserved fibre which can be readily identified as to botanical origin.

moderate - intermediate amounts of fibre are present, which can be identified as to botanical origin; plant structures becoming indistinct.

well - highly decomposed materials, very little fiber can be identified as to botanical origin and fibres are readily destroyed by rubbing.

11. Mineral Soil Texture: is described for particles smaller than 2 mm in diameter and follows the textural classes described by Canada Soil Survey Committee (1978a).

12. Soil Drainage: refers to the rate at which water is removed relative to the addition of water. Three of the seven classes described in Canada Soil Survey Committee (1978b) are used here for wetlands: imperfectly drained, poorly drained, and very poorly drained.

13. Rooting Depth: indicates the modal depth and range of depths to which the majority of plant roots extend.

14. Soil Classification: soil subgroups (Canada Soil Survey Committee 1978a) are listed in order of predominance.

15. Wetland Classification: lists the predominant wetland class and subclass(es) to which the association belongs, according to Runka and Lewis (1981). Predominant subclass(es) is listed without brackets.

16. Site/Soil Comments: general comments which highlight important site or soil characteristics and which, when combined with the above, help to describe the ecosystem association.

17. Characteristic Vegetation: the combination of plants listed characterizes the vegetation of the association. They are present in more than 60% of the plot samples and include the dominant species. Plant species are listed by vegetation layer:

    shrub - woody plants less than 10 m tall but with erect stems usually more than 15 cm tall; includes both tall (>2 m) and low (<2 m) shrubs.

    herb - all herbaceous vascular plants, regardless of height, and woody plants with decumbent stems less than 15 cm tall.

    moss - all ground-dwelling mosses, liverworts and lichens.

18. Vegetation Comments: general comments to highlight important vegetation features, including structure, diagnostic species, and common or predominant species.

19. Wetland Sequence: summarizes the typical position of a wetland association in the sequence of associations which occurs from the wet centre to the drier margins of a wetland. This wetland sequence is also diagramed. The sequence position described is considered to be the most common, based on extensive surveys, but others may also occur.

20. Association Diagram: an artistic illustration of the appearance of a typical representative of the association. These are provided to assist the manager in forming a visual impression of the vegetation and mid-season relative water depths. A subsurface profile indicates relative thickness of organic and various mineral materials within the upper 150 cm of the soil. Scale of the vegetation is indicated by including an animal of commonly known size in the diagram.

4 WETLAND ECOSYSTEM UNITS OF THE IDFb2

This section describes the wetland ecosystem units of the IDFb2 in the Cariboo Forest Region. A key for field identification of ecosystem units and tables of management interpretations are also included. Finally, the ecosystem units included in this classification are compared with units of other Cariboo wetland classifications, particularly those in Runka and Lewis (1981) and Tarnocai (1980).

4.1 Provisional Key to Non-Forested Wetland Ecosystem Units of the IDFb2

1a. Open water with less than 10% cover of emergent plants.
Shallow Open Water Ecosystems[7]

1b. Not open water; if standing water covers site then emergent plant cover greater than 10%.

2a. Vegetation dominated by cattail (Typha latifolia), great bulrush (Scirpus lacustris), or seaside arrowgrass (Triglochin maritimum); substrate either mineral or mineral-rich organic; mid-season standing water depths usually greater than 20 cm (Marsh Ecosystems).

3a. Vegetation dominated by tall (> 1 m) emergent species; mid-season standing water depths usually greater than 40 cm.

4a. Great bulrush dominant.
IDFb2/W14 Great Bulrush Marsh (p.50)

4b. Cattail dominant.
IDFb2/W13 Cattail Marsh (p.48)

3b. Vegetation dominated by shorter (< 1 m) emergent species; seaside arrowgrass abundant; mid-season standing water depths usually less than 40 cm.
IDFb2/W12 Arrowgrass Marsh (p.46)

2b. Vegetation not dominated by cattail, great bulrush or seaside arrowgrass; substrate various but may be all organic; mid-season standing water depths variable (0-100 cm).

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[7] This ecosystem group is not further subdivided; no shallow open water ecosystem associations have yet been defined.

5a. Organic accumulations greater than 15 cm thick over mineral soil; vegetation rooted primarily in organic materials; standing water often present in mid-season.

6a. Organic accumulations primarily sphagnum (Sphagnum spp)- derived peats; vegetation includes extensive moss cover dominated by sphagnum mosses with variable amounts of ericaceous shrubs, sedges, lichens, and scattered trees.

Bog ecosystems[8]

6b. Organic accumulations not sphagnum-derived peats; sphagnum mosses absent or scarce; vegetation most often dominated by shrubs, sedges, or non-sphagnum mosses.

7a. Shrub cover greater than 5%; early season standing water depths usually less than 30 cm.

8a. Permanent or nearly permanent subsurface water flow present, sites most often include small permanent or ephemeral streams; shrub layer dominated by tall (>2 m) willows, especially tea-leaved willow (Salix planifolia) or Mackenzie's willow (Salix mackenzieana).

IDFb2/W6 Tall willow - Sartwell's sedge Swamp (p.34)

8b. No significant subsurface water flow present; sites do not include channeled streams; any surface flow is very slow and down very low gradient slopes; shrub layer dominated by various species.

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[8] Bog ecosystems are very uncommon in the IDFb2 and no ecosystem associations have been described.

9a. Tall (> 2 m) shrubs present; shrub layer usually dominated by Maccall's willow (Salix maccalliana), but several other willows and scrub birch (Betula glandulosa) usually present.
IDFb2/W5 Maccall's willow - Beaked sedge Fen (p.32)

9b. Tall shrubs absent; shrub layer consists of sparse to moderate (5-50%) cover of low shrubs dominated most often by hoary willow (Salix candida), scrub birch, and bog willow (Salix pedicellaris).
IDFb2/W7 Low willow - Buckbean Fen (p.36)

7b. Shrub cover less than 5%; early season standing water depths often greater than 30 cm.

10a. Buckbean (Menyanthes trifoliata) abundant (> 10% cover) and usually dominating herbaceous layer; late - season standing water depths usually greater than 15 cm.
IDFb2/W11 Buckbean - Slender sedge Fen (p. 44)

10b. Buckbean not abundant, (< 10% cover) herbaceous vegetation dominated by sedges; late-season standing water depths usually less than 15 cm.

11a. Water sedge (Carex aquatilis) and/or beaked sedge (Carex rostrata) dominate herbaceous layer, forming nearly continuous cover.
IDFb2/W9 Beaked sedge - Water sedge Fen (p.40)

11b. Slender sedge (Carex lasiocarpa) or awned sedge (Carex atherodes) dominate herbaceous layer.

12a. Slender sedge dominant; moss cover well developed; soil organic accumulations usually greater than 40 cm thick.
IDFb2/W10 Slender sedge - Moss Fen (p.42)

12b. Awned sedge dominant; moss cover usually sparse; soil organic accumulations most often less than 40 cm.
IDFb2/W8 Awned sedge Fen-Marsh (p.38)

5b. Organic accumulations less than 15 cm thick over mineral soil; vegetation rooted primarily in mineral soil; standing water usually not present in mid-season (except in 13a).

13a. Sites seasonally inundated, standing water usually present in mid-growing season; vegetation dominated by sedges; awned sedge abundant.
IDFb2/W8 Awned sedge Fen-Marsh (p.38)

13b. Sites rarely or only briefly inundated, standing water absent in mid-growing season; vegetation dominated by low shrubs, grasses, rushes, and/or forbs.

14a. Low (< 2 m) shrubs abundant (>5% cover), shrub layer dominated by scrub birch and short-fruited willow (Salix brachycarpa); kinnikinnick (Arctostaphylos uva-ursi) and mat muhly (Muhlenbergia richardsonis) usually present.
IDFb2/W4 Scrub birch - Kinnikinnick Shrub-Carr (p.30)

14b. Low shrubs absent or scarce (< 5% cover); meadow ecosystems.

15a. Alkali saltgrass (*Distichlis stricta*) dominates vegetation; seablite (*Suaeda depressa*) usually present; vegetation cover sparse (< 50%).
IDFb2/W1 Alkali saltgrass - Nuttall's alkaligrass Meadow (p.24)

15b. Alkali saltgrass and seablite absent or scarce; vegetation cover usually greater than 50%.

16a. Vegetation includes less than five species with 1% or greater cover; Nuttall's alkaligrass (*Puccinellia nuttalliana*) and/or foxtail barley (*Hordeum jubatum*) dominant; arctic rush (*Juncus arcticus*) absent.
IDFb2/W2 Alkaligrass - Foxtail barley Meadow (p. 26)

16b. Vegetation includes five or more species with 1% or greater cover; arctic rush, field sedge (*Carex praegracilis*), silverweed (*Potentilla anserina*) and a variety of other forbs and grasses usually present.
IDFb2/W3 Arctic rush - Field sedge Meadow (p.28)

4.2 Ecosystem Unit Descriptions

Descriptions of the 14 ecosystem associations encountered in the IDFb2 are presented on the following pages, generally in order of increasing wetness:

Meadows

IDFb2/W1	Alkali saltgrass - Nuttall's alkaligrass Meadow
IDFb2/W2	Nuttall's alkaligrass - Foxtail barley Meadow
IDFb2/W3	Arctic rush - Field sedge Meadow

Shrub-carrs

IDFb2/W4	Scrub birch - Kinnikinnick Shrub-Carr

Tall Shrub Fens

IDFb2/W5	Maccall's willow - Beaked sedge Fen

Tall Shrub Swamps

IDFb2/W6	Tall willow - Sartwell's sedge Swamp

Low Shrub Fens

IDFb2/W7	Low willow - Buckbean Fen

Sedge Fens

IDFb2/W8	Awned sedge Fen-Marsh
IDFb2/W9	Beaked sedge - Water sedge Fen
IDFb2/W10	Slender sedge - Moss Fen
IDFb2/W11	Buckbean - Slender sedge Fen

Marshes

IDFb2/W12	Seaside arrowgrass Marsh
IDFb2/W13	Cattail Marsh
IDFb2/W14	Great bulrush Marsh

IDFb2/W1

ECOSYSTEM UNIT: ALKALI SALTGRASS - NUTTALL'S ALKALIGRASS MEADOW ASSOCIATION (*Distichlis stricta* - *Puccinellia nuttalliana* Meadow Association)

MOISTURE REGIME:	subhygric
SURFACE WATER:	seasonal, disappearing by mid-season
SUBSURFACE FREE WATER:	100-150 cm
HYDROTOPOGRAPHIC POSITION:	lowland (linked basin) palustrine
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	uncommon/small
PARENT MATERIAL:	clayey lacustrine blanket evaporite carbonate deposits
ORGANIC - DEPTH:	N/A
- DECOMPOSITION;	N/A
MINERAL SOIL TEXTURE:	silty clay
SOIL DRAINAGE:	imperfect
ROOTING DEPTH:	45 (30-60) cm
SOIL CLASSIFICATION:	Alkaline Solonetz Gleyed Eutric Brunisol
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Saline Mineral Meadow

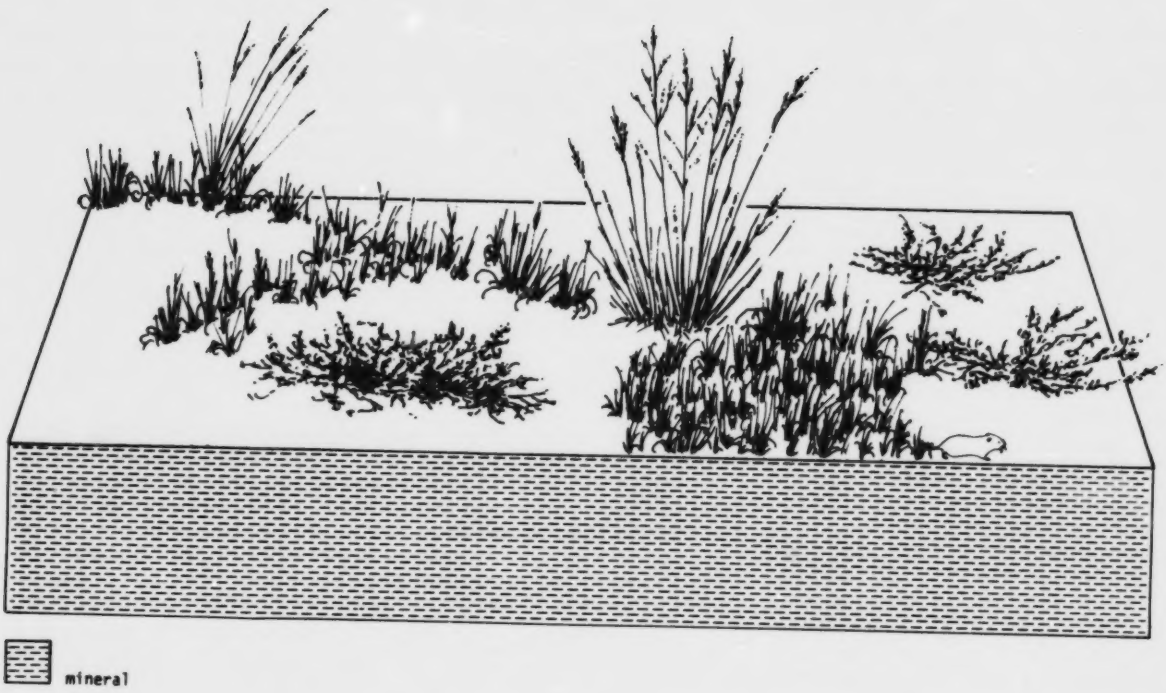
SITE/SOIL COMMENTS: These ecosystems may have standing water during spring flood but become dry by mid-growing season. Soils are mineral with little organic accumulation, and are saline. Salt crusts are frequently evident when surfaces become dry.

CHARACTERISTIC VEGETATION (by layer):

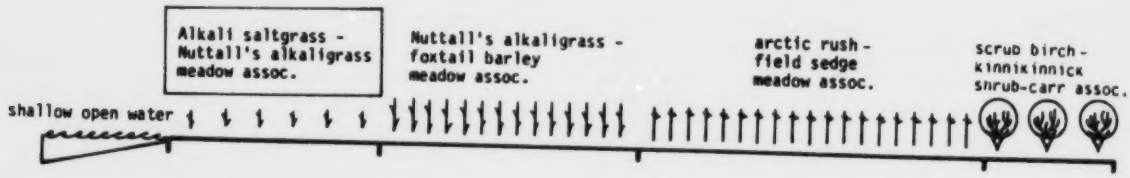
HERB	Alkali saltgrass	*Distichlis stricta*
	Nuttall's Alkaligrass	*Puccinellia nuttalliana*
	Seablite	*Suaeda depressa*
	Nevada bulrush	*Scirpus nevadensis*

VEGETATION COMMENTS: This meadow association has very few species and a low total plant cover, usually less than 50%. Alkali saltgrass is usually present. High salinity levels severely restrict plant growth.

IDFb2/W1 ALKALI SALTGRASS - NUTTALL'S ALKALIGRASS MEADOW ASSOCIATION
(Distichlis stricta - Puccinellia nuttalliana Meadow Association)



WETLAND SEQUENCE: This meadow association usually occupies a small proportion of a wetland, surrounded by more diverse meadow communities, with or without a shrub-carr on the periphery.


Alkali saltgrass - Nuttall's alkaligrass meadow assoc.
Nuttall's alkaligrass - foxtail barley meadow assoc.
arctic rush - field sedge meadow assoc.
scrub birch - kinnikinnick shrub-carr assoc.
shallow open water

IDFb2/W2

ECOSYSTEM UNIT: NUTTALL'S ALKALIGRASS - FOXTAIL BARLEY MEADOW ASSOCIATION
(*Puccinellia nuttalliana* - *Hordeum jubatum* Meadow Association)

MOISTURE REGIME:	subhygric
SURFACE WATER:	seasonal, seldom present in mid-season
SUBSURFACE FREE WATER:	0-100 cm
HYDROTOPOGRAPHIC POSITION:	linked basin lacustrine and closed basin palustrine
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	common/medium
PARENT MATERIAL:	clayey lacustrine
ORGANIC - DEPTH:	N/A
- DECOMPOSITION:	N/A
MINERAL SOIL TEXTURE:	silty clay and silty clay loam
SOIL DRAINAGE:	imperfect to poor
ROOTING DEPTH:	30 cm
SOIL CLASSIFICATION:	Orthic Gleysol (Orthic Humic Gleysol)
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Saline Mineral Meadow

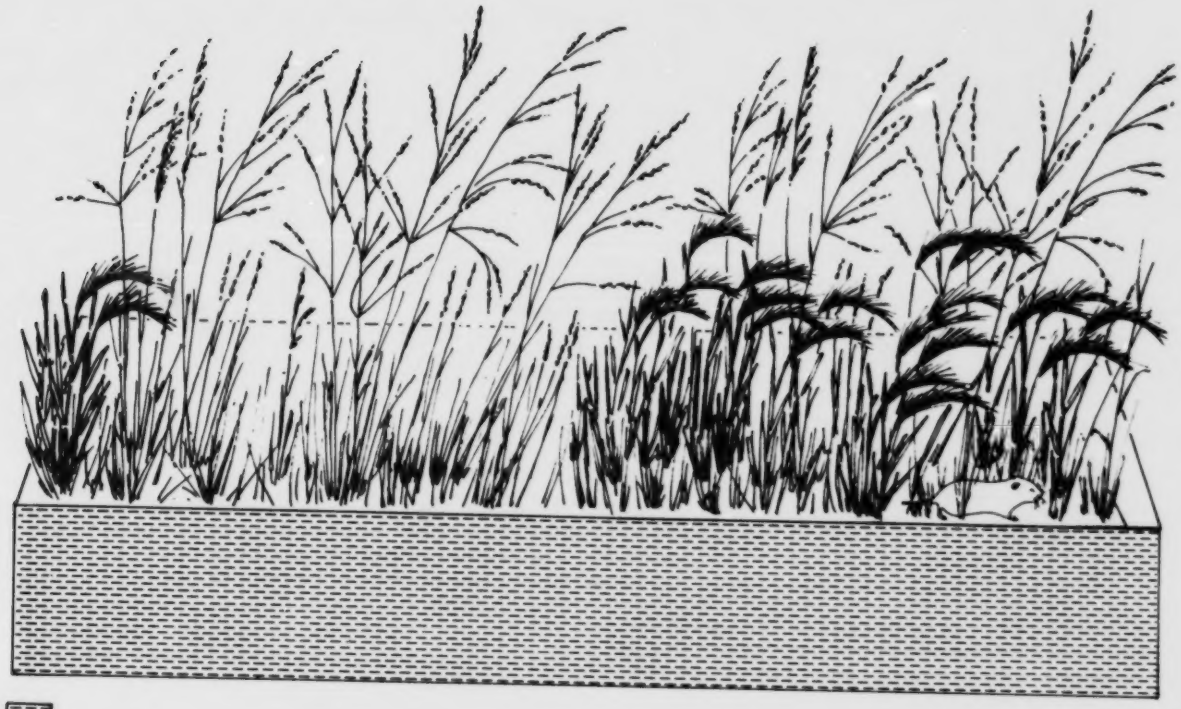
SITE/SOIL COMMENTS: These meadow ecosystems occur on mineral soils in southern portions of the IDFb2, Cariboo Forest Region. Soils are strongly carbonated but do not possess the solonetzic horizon common in IDFb2/W1. Standing water is seldom present.

CHARACTERISTIC VEGETATION (by layer):

HERB	Nuttall's alkaligrass	*Puccinellia nuttalliana*
	Foxtail barley	*Hordeum jubatum*

VEGETATION COMMENTS: Vegetation cover is usually greater than 50%. Alkaligrass dominates this association where it is wetter, foxtail barley where it is drier; occasionally these grasses co-dominate. A high cover of Nevada bulrush (*Scirpus nevadensis*) may be present.

IDFb2/W2 NUTTALL'S ALKALIGRASS - FOXTAIL BARLEY MEADOW ASSOCIATION
(Puccinellia nuttalliana - Hordeum jubatum Meadow Association)



mineral

WETLAND SEQUENCE: This association often occupies 30-45% of a wetland area as part of a sequence from shallow open water, with or without arrowgrass, to an Arctic rush - Field sedge Meadow Association. An outer border of shrubs may be present.

shallow open water
arrowgrass marsh assoc.
Nuttall's alkaligrass - foxtail barley meadow assoc.
arctic rush - field sedge meadow assoc.

IDFb2/W3

ECOSYSTEM UNIT: ARCTIC RUSH - FIELD SEDGE MEADOW ASSOCIATION
(Juncus arcticus - Carex praegracilis Meadow Association)

MOISTURE REGIME:	subhygric and hygric
SURFACE WATER:	seasonal, disappearing by midseason
SUBSURFACE FREE WATER:	30-150 cm
HYDROTOPOGRAPHIC POSITION:	linked basin (lowland) palustrine
SLOPE POSITION/SHAPE:	depression/straight
OCCURRENCE/SIZE:	common/medium
PARENT MATERIAL:	clayey lacustrine
ORGANIC - DEPTH:	0-10 cm
- DECOMPOSITION:	N/A
MINERAL SOIL TEXTURE:	silty clay loam and silty clay
SOIL DRAINAGE:	imperfect and poor
ROOTING DEPTH:	45 (35-50) cm
SOIL CLASSIFICATION:	Orthic Humic Gleysol Gleyed Eluviated Eutric Brunisol
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Saline Mineral Meadow

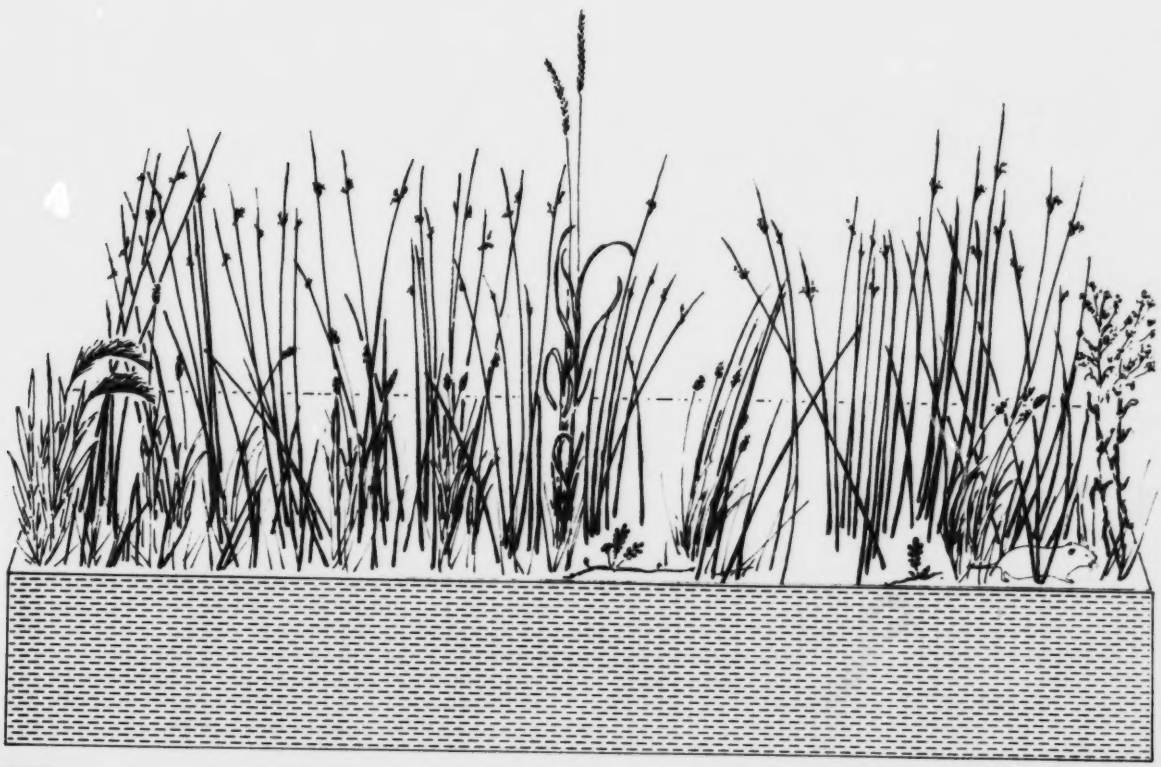
SITE/SOIL COMMENTS: These meadow ecosystems are rarely inundated, although surfaces are usually wet in early growing season. Soils are mineral and have little organic matter accumulation. They are strongly carbonated.

CHARACTERISTIC VEGETATION (by layer):

HERB	Arctic rush	Juncus arcticus
	Field sedge	Carex praegracilis
	Slender wheatgrass	Agropyron trachycaulum
	Tufted white prairie aster	Aster pansus
	Silverweed	Potentilla anserina
	Foxtail barley	Hordeum jubatum
	Nuttall's Alkaligrass	Puccinellia nuttalliana
	Alkali bluegrass	Poa juncifolia
	Kentucky bluegrass	Poa pratensis
	Parry's sedge	Carex parryana
	Early blue violet	Viola adunca

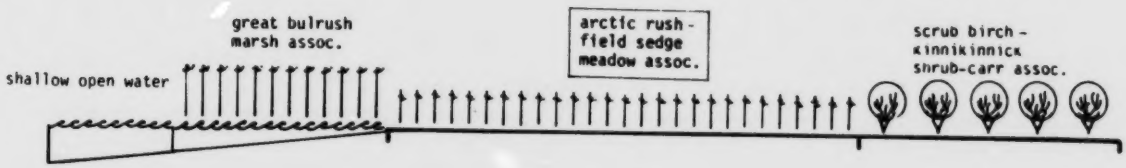
VEGETATION COMMENTS: Rushes, sedges, and grasses are typically dominant in this moderately diverse association. Silverweed and tufted white prairie aster are commonly present. Mosses, if present, have a low cover.

IDFb2/W3 ARCTIC RUSH - FIELD SEDGE MEADOW ASSOCIATION
(Juncus arcticus - Carex praegracilis Meadow Association)



mineral

WETLAND SEQUENCE: This meadow association may cover 100% of a wetland area, or it may be part of a sequence from shallow open water, with or without bulrush, to a shrub-carr on the periphery. The Nuttall's alkaligrass - Foxtail barley Meadow Association may also be part of this sequence.


great bulrush marsh assoc.
arctic rush - field sedge meadow assoc.
scrub birch - kinnikinnick shrub-carr assoc.
shallow open water

IDFb2/W4

ECOSYSTEM UNIT: SCRUB BIRCH - KINNIKINNICK SHRUB-CARR ASSOCIATION (*Betula glandulosa* - *Arctostaphylos uva-ursi* Shrub-Carr Association)

MOISTURE REGIME:	subhygric (hygric)
SURFACE WATER:	seasonal, seldom present
SUBSURFACE FREE WATER:	30-130 cm
HYDROTOPOGRAPHIC POSITION:	linked (closed) basin palustrine
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	common/small to medium
PARENT MATERIAL:	clayey lacustrine (silty to loamy fluvial)
ORGANIC - DEPTH:	0-10 cm
- DECOMPOSITION:	N/A
MINERAL SOIL TEXTURE:	silt loam and silty clay loam
SOIL DRAINAGE:	imperfect to poor
ROOTING DEPTH:	30-50 cm
SOIL CLASSIFICATION:	Orthic Humic Gleysols Gleyed Melanic and Eutric Brunisols Orthic Melanic Brunisol
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Saline Mineral (Organic) Shrub-Carr

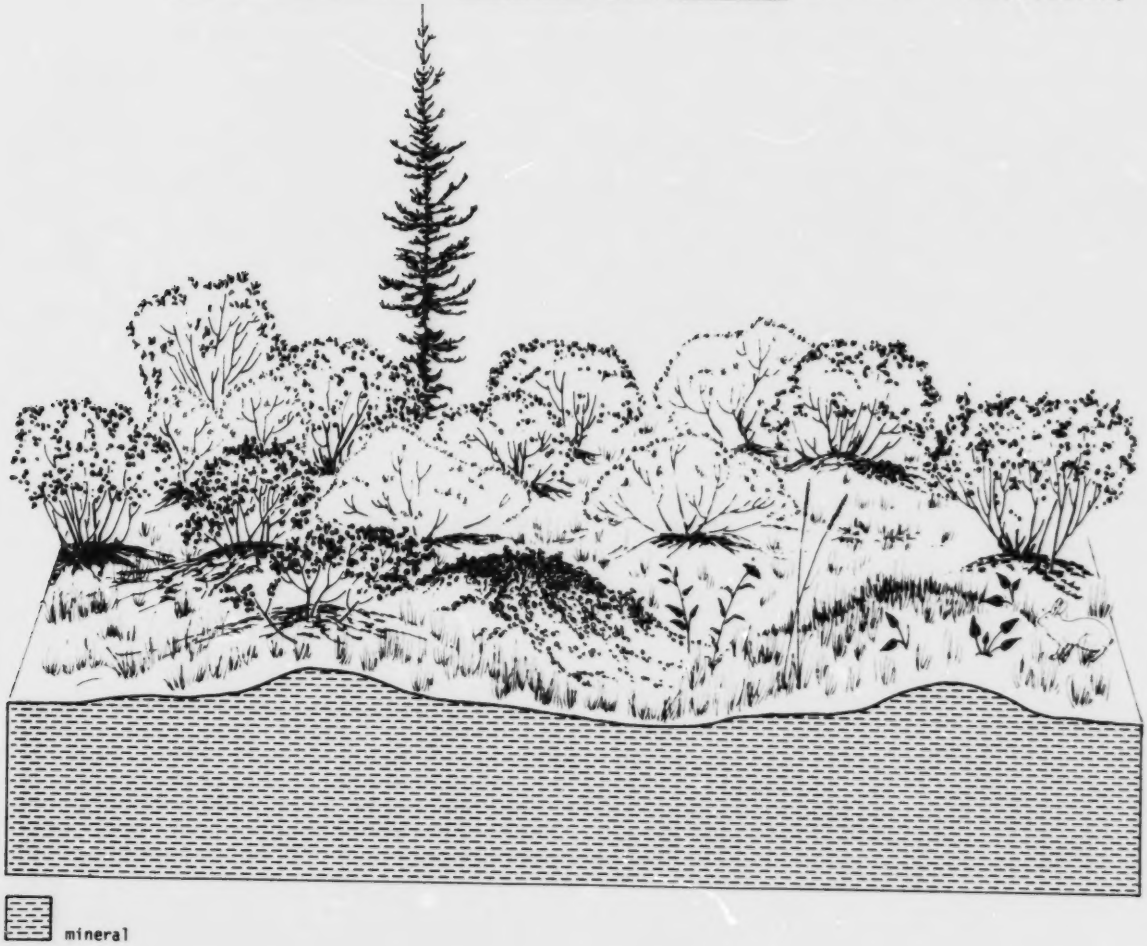
SITE/SOIL COMMENTS: These ecosystems usually occur at the periphery of wetlands and are rarely, if ever, inundated. Surfaces are usually hummocky with relatively dry organic-rich hummocks and moist depressions. Soils are often carbonated.

CHARACTERISTIC VEGETATION (by layer):

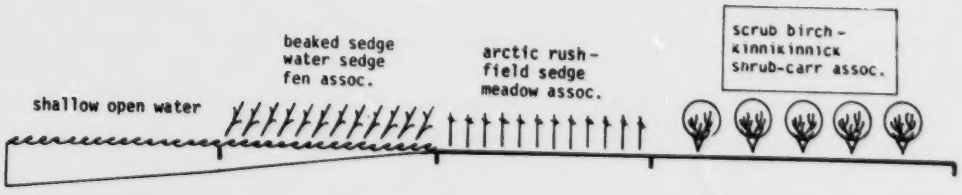
SHRUB	Hybrid white spruce	*Picea glauca x engelmannii*
	Scrub birch	*Betula glandulosa*
	Short-fruited willow	*Salix brachycarpa*
HERB	Kinnikinnick	*Arctostaphylos uva-ursi*
	Mat muhly	*Muhlenbergia richardsonis*
	Slender wheatgrass	*Agropyron trachycaulum*
	Arctic rush	*Juncus arcticus*
	Field sedge	*Carex praegracilis*
	Yarrow	*Achillea millefolium*
	Star-flowered false Solomon's seal	*Smilacina stellata*
	Tufted white prairie aster	*Aster pansus*
	Fringed aster	*Aster ciliolatus*

VEGETATION COMMENTS: The vegetation is dominated by low (< 2 m) shrubs growing primarily on hummocks. Kinnikinnick, mat muhly, and slender wheatgrass are usually present in the herb layer. Grey-leaved willow (*Salix glauca*), Parry's sedge (*Carex parryana*), and early blue violet (*Viola adunca*) are also common.

IDFb2/W4 SCRUB BIRCH - KINNIKINNICK SHRUB-CARR ASSOCIATION
(Betula glandulosa - Arctostaphylos uva-ursi Shrub-Carr Association)



WETLAND SEQUENCE: This shrub-carr association may dominate a wetland, but most frequently forms a border to meadows, sedge fens, or shrub-covered fens.



IDFb2/W5

ECOSYSTEM UNIT: MACCALL'S WILLOW - BEAKED SEDGE FEN ASSOCIATION
(*Salix maccalliana* - *Carex rostrata* Fen Association)

MOISTURE REGIME:	hygric and subhydric
SURFACE WATER:	seasonal, 0-20 cm
SUBSURFACE FREE WATER:	0-100 cm
HYDROTOPOGRAPHIC POSITION:	highly variable: (linked, terminal, closed) basin palustrine, stream riverine
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	common/small
PARENT MATERIAL:	organic
ORGANIC - DEPTH:	50-150+ cm
- DECOMPOSITION:	moderate to well
MINERAL SOIL TEXTURE:	N/A
SOIL DRAINAGE:	poor to very poor
ROOTING DEPTH:	65 (20-130) cm
SOIL CLASSIFICATION:	Typic Humisols Humic and Typic Mesisols
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Deep Mesic Fen

SITE/SOIL COMMENTS: Standing water is shallow (< 20 cm) and usually absent by mid-season. Soils are usually saturated within the rooting zone. Soil organic accumulations are usually greater than 1 m. Soils are not carbonated.

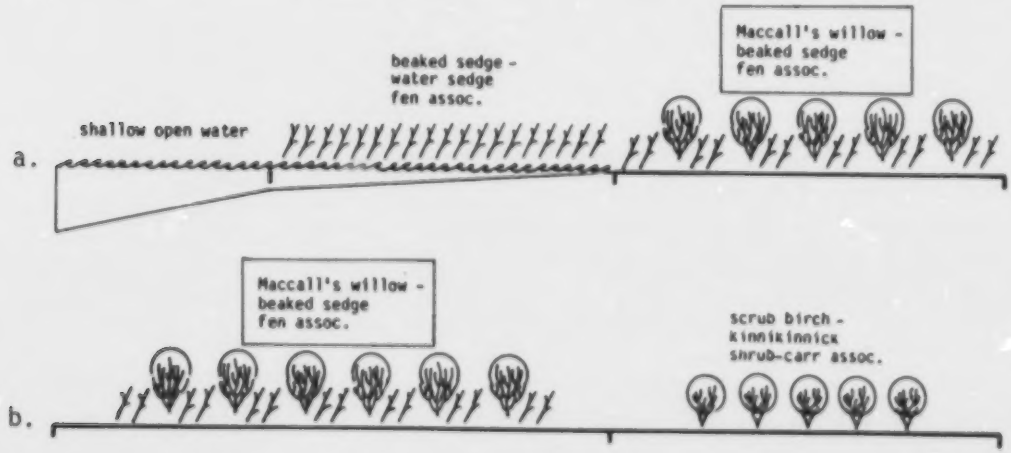
CHARACTERISTIC VEGETATION (by layer):

SHRUB	Maccall's willow	*Salix maccalliana*
	Scrub birch	*Betula glandulosa*
	Tea-leaved willow	*Salix planifolia*
	Grey-leaved willow	*Salix glauca*
	Hybrid white spruce	*Picea glauca* x *engelmannii*
HERB	Beaked sedge	*Carex rostrata*
	Water sedge	*Carex aquatilis*
	Pink wintergreen	*Pyrola asarifolia*
	Rush aster	*Aster borealis*
MOSS		*Drepanocladus aduncus* *Tomenthypnum nitens*

VEGETATION COMMENTS: This variable association is characterized by a high cover of shrubs (>60%) with beaked sedge and water sedge in wet depressions. Grasses (*Glyceria* spp. and *Calamagrostis* spp.) are commonly present . Most other herbaceous growth is found on the hummocks associated with the shrubs. A variety of mosses occur, including *Sphagnum* spp. in some areas.

IDFb2/W5 MACCALL'S WILLOW - BEAKED SEDGE FEN ASSOCIATION
(Salix maccalliana - Carex rostrata Fen Association)

WETLAND SEQUENCE: This shrub association may border an area of Beaked sedge - Water sedge Fen (a), or it may form the central part of a wetland with a drier shrub-carr border (b).


Maccall's willow - beaked sedge fen assoc.
beaked sedge - water sedge fen assoc.
shallow open water
a.
Maccall's willow - beaked sedge fen assoc.
scrub birch - kinnikinnick shrub-carr assoc.
b.

IDFb2/W6

ECOSYSTEM UNIT: TALL WILLOW - SARTWELL'S SEDGE SWAMP ASSOCIATION
(*Salix* spp. - *Carex sartwellii* Swamp Association)

MOISTURE REGIME:	hygric to hydric
SURFACE WATER:	0-20 cm
SUBSURFACE FREE WATER:	0-30 cm.
HYDROTOPOGRAPHIC POSITION:	stream riverine
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	uncommon/small
PARENT MATERIAL:	organic or loamy morainal blanket
ORGANIC - DEPTH:	0-150+ cm
- DECOMPOSITION:	moderate to well
MINERAL SOIL TEXTURE:	variable
SOIL DRAINAGE:	poor to very poor
ROOTING DEPTH:	45 (20-70) cm
SOIL CLASSIFICATION:	Humic Mesisol Terric and Typic Humisol Peaty Rego Humic Gleysol
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Shrub Organic (Mineral) Swamp

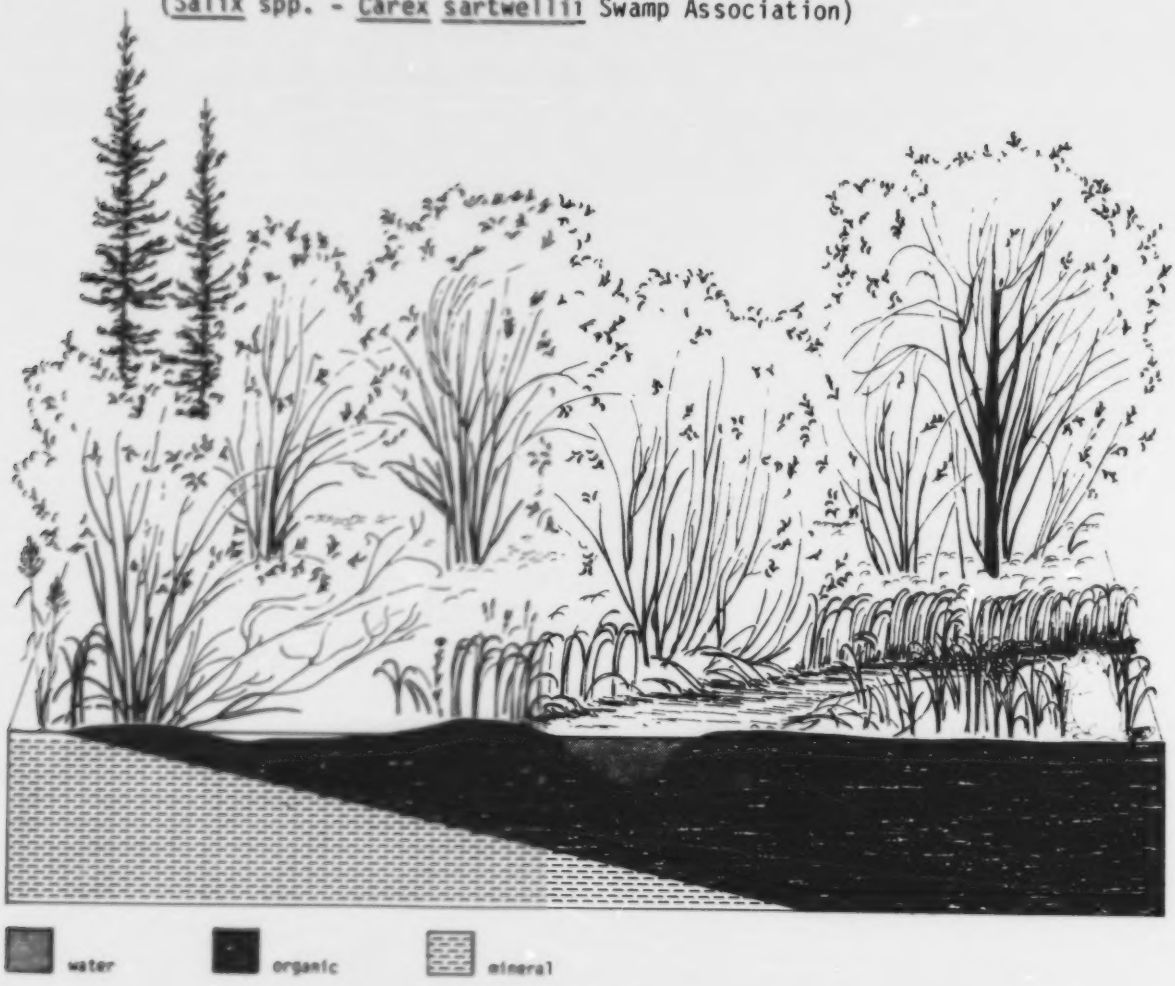
SITE/SOIL COMMENTS: These ecosystems are associated with streams and rivers and are enriched by surface and subsurface water flow, bringing nutrients and sediments. Small channels and pools are often evident. Soils are usually saturated near the surface throughout the growing season. Organic accumulations are absent to thick (0 to over 150 cm).

CHARACTERISTIC VEGETATION (by layer):

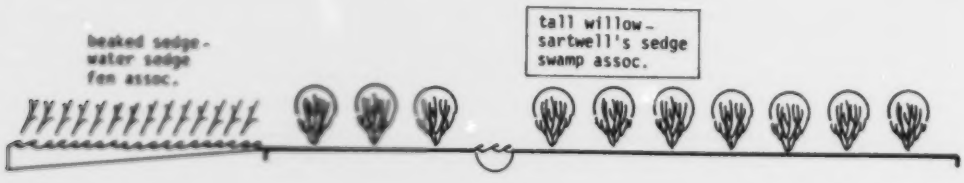
SHRUB	Hybrid white spruce	*Picea glauca x engelmannii*
	Grey-leaved willow	*Salix glauca*
	Tea-leaved willow	*Salix planifolia*
	Mackenzie's willow	*Salix mackenziana*
	Maccall's willow	*Salix maccalliana*
HERB	Beaked sedge	*Carex rostrata*
	Water sedge	*Carex aquatilis*
	Sartwell's sedge	*Carex sartwellii*
	Pink wintergreen	*Pyrola asarifolia*
	Small bedstraw	*Galium trifidum*
	Rush aster	*Aster borealis*
	Fowl mannagrass	*Glyceria striata*
MOSS		*Aulacomnium palustre*
		Drepanocladus aduncus
		Mnium rugicum

VEGETATION COMMENTS: This species rich association is dominated by tall willows. In the herb layer Sartwell's sedge as well as beaked sedge and water sedge are usually present. Mosses are always present.

IDFb2/W6 TALL WILLOW - SARTWELL'S SEDGE SWAMP ASSOCIATION
(Salix spp. - Carex sartwellii Swamp Association)



WETLAND SEQUENCE: This swamp association may cover 100% of a channelled form of wetland, or it may be interspersed with a Beaked sedge - Water sedge Fen Association and/or a Maccall's willow - Beaked sedge Fen Association.



IDFb2/W7

ECOSYSTEM UNIT: LOW WILLOW - BUCKBEAN FEN ASSOCIATION
(*Salix* spp. - *Menyanthes trifoliata* Fen Association)

MOISTURE REGIME:	subhydric (hydric)
SURFACE WATER:	seasonal, 0-20 cm
SUBSURFACE FREE WATER:	0-20 cm
HYDROTOPOGRAPHIC POSITION:	closed basin (linked basin, lowland) palustrine
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	common/small
PARENT MATERIAL:	organic
ORGANIC - DEPTH:	100 to 150+ cm
- DECOMPOSITION:	poor to moderate
MINERAL SOIL TEXTURE:	N/A
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	80 (70-100) cm
SOIL CLASSIFICATION:	Typic Fibrisol Typic Mesisol (Limno Mesisol)
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Deep Fibric (Mesic) Fen

SITE/SOIL COMMENTS: Standing water is usually absent by mid-season but soils are permanently saturated near the surface. Organic materials are usually deeper than 100 cm. Soils are usually not carbonated. These fens are often managed for hay production.

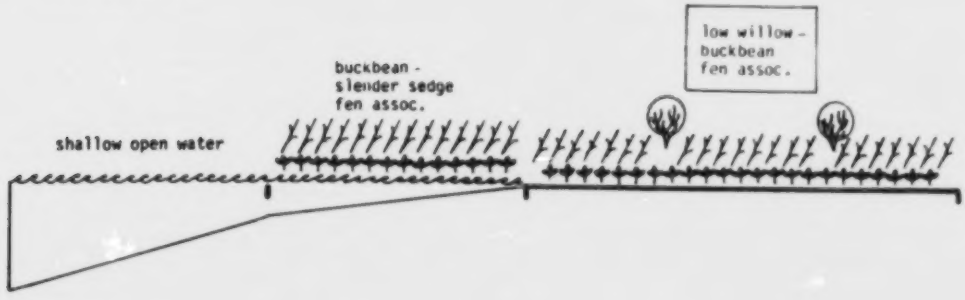
CHARACTERISTIC VEGETATION (by layer):

SHRUB	Scrub birch	*Betula glandulosa*
	Hoary willow	*Salix candida*
	Bog willow	*Salix pedicellaris*
HERB	Slender sedge	*Carex lasiocarpa*
	Water sedge	*Carex aquatilis*
	Shore sedge	*Carex limosa*
	Buckbean	*Menyanthes trifoliata*
	Seaside arrowgrass	*Triglochin maritimum*
	Lesser panicled sedge	*Carex diandra*
MOSS		*Drepanocladus aduncus*
		Brachythecium spp.

VEGETATION COMMENTS: Shrub cover is typically sparse, although evenly distributed. The herb layer is dominated by buckbean and several species of sedge. Swamp horsetail (*Equisetum fluviatile*) and marsh cinquefoil (*Potentilla palustris*) sometimes occur. The moss layer is well developed, often forming a thick mat. Sphagnum moss is sometimes present on the border of this association. Aquatic plants can occur.

IDFb2/W7 LOW WILLOW - BUCKBEAN FEN ASSOCIATION
(Salix spp. - Menyanthes trifoliata Fen Association)

WETLAND SEQUENCE: This association may cover the main part of a wetland with a tall shrub border, or be on the periphery of a Buckbean - Slender sedge Fen Association.



IDFb2/W8

ECOSYSTEM UNIT: AWNED SEDGE - FEN-MARSH ASSOCIATION
(*Carex atherodes Fen-Marsh Association*)

MOISTURE REGIME:	subhydric (hygric to hydric)
SURFACE WATER:	seasonal (permanent), 0-50 cm
SUBSURFACE FREE WATER:	0-50 cm
HYDROTOPOGRAPHIC POSITION:	closed basin palustrine
SLOPE POSITION/SHAPE:	depression/concave
OCCURRENCE/SIZE:	uncommon/small
PARENT MATERIAL:	organic veneer over silty to clayey lacustrine blanket
ORGANIC - DEPTH:	0-150+ cm
- DECOMPOSITION:	moderate to well
MINERAL SOIL TEXTURE:	Silty clay loam
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	40 (20-50) cm
SOIL CLASSIFICATION:	Orthic Humic Gleysol Typic Humisol
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Deep or Shallow Marsh (Marl Limnic or Humic Fen)

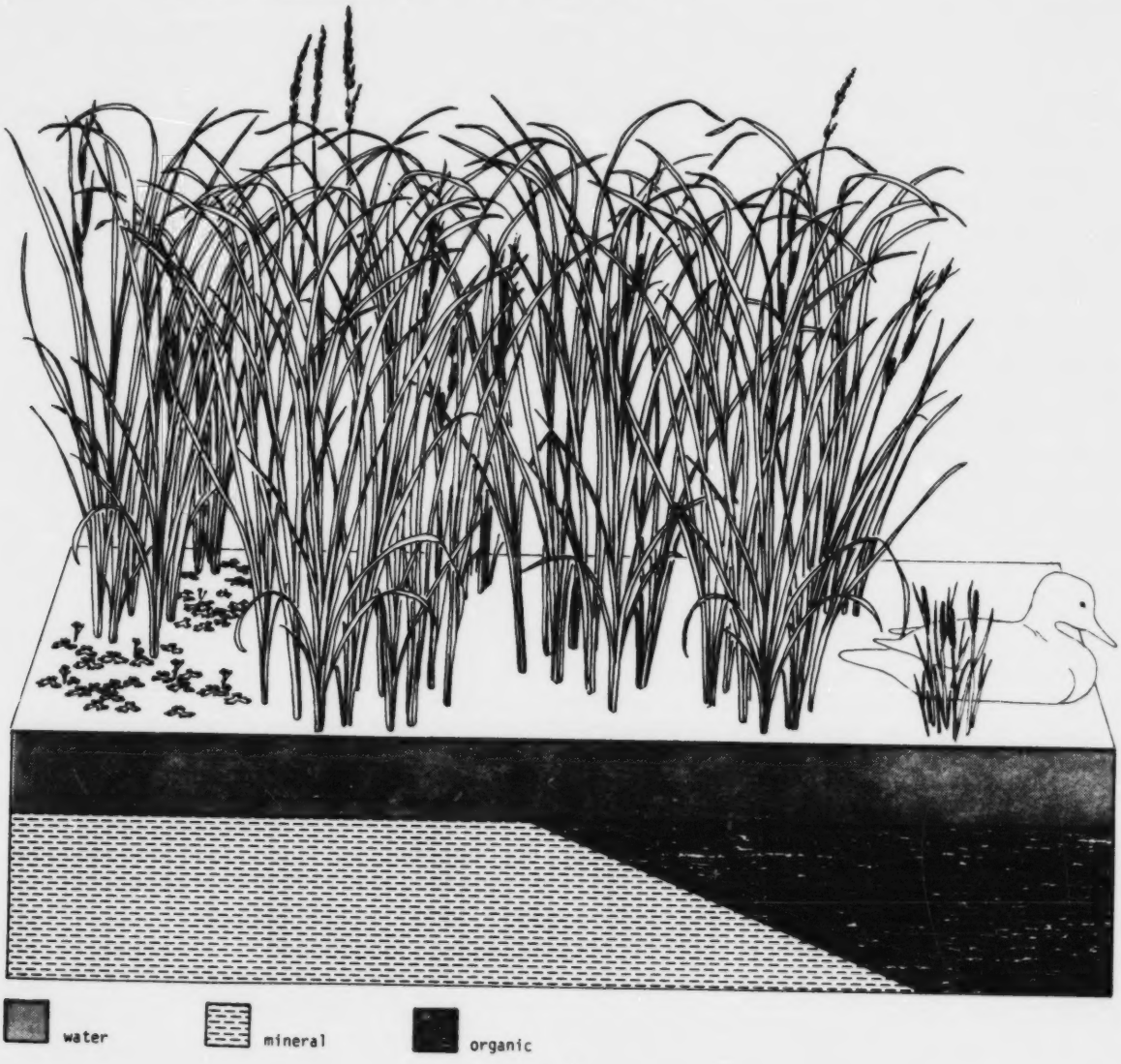
SITE/SOIL COMMENTS: These ecosystems are seasonally or permanently inundated. Soils are variable with organic layer thicknesses of 0 to over 100 cm. Rooting is most often concentrated in the surface organic layers and is usually sparse in the underlying mineral soil. Surface soils are occasionally carbonated.

CHARACTERISTIC VEGETATION (by layer):

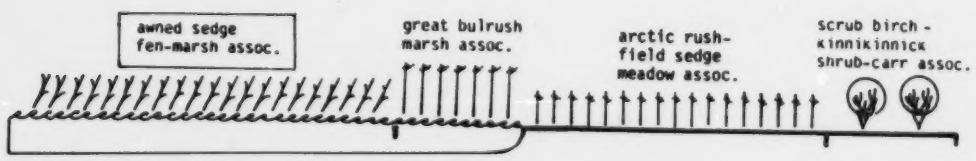
HERB	Awned sedge	*Carex atherodes*
	Sloughgrass	*Beckmannia syzigachne*
	Small yellow water-buttercup	*Ranunculus gmelinii*

VEGETATION COMMENTS: Awned sedge is the dominant species of this variable association, although sloughgrass and some beaked sedge (*Carex rostrata*) may occur. Other grasses such as slim stem reedgrass (*Calamagrostis stricta*) or little meadow-foxtail (*Alopecurus aequalis*) may also be present. Small yellow water-buttercup is a frequent aquatic plant.

IDFb2/W8 AWNED SEDGE - FEN-MARSH ASSOCIATION
(Carex atherodes Fen-Marsh Association)



WETLAND SEQUENCE: This association is often found in a central position with or without a small area of bulrush, and surrounded by a drier meadow with a shrub-carr border.


awned sedge fen-marsh assoc.
great bulrush marsh assoc.
arctic rush-field sedge meadow assoc.
scrub birch - kinnikinnick shrub-carr assoc.

IDFb2/W9

ECOSYSTEM UNIT: BEAKED SEDGE - WATER SEDGE FEN ASSOCIATION
(*Carex rostrata* - *Carex aquatilis* Fen Association)

MOISTURE REGIME:	subhydric to hydric
SURFACE WATER:	seasonal, 0-40 cm
SUBSURFACE FREE WATER:	0-50 (80)cm
HYDROTOPOGRAPHIC POSITION:	palustrine linked basin (closed basin)
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	common/medium to small
PARENT MATERIAL:	organic blanket
ORGANIC - DEPTH:	30-150+ cm
- DECOMPOSITION:	moderate
MINERAL SOIL TEXTURE:	N/A
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	50 (40-70) cm
SOIL CLASSIFICATION:	Typic Mesisol (Fibric and Terric Mesisols) (Limno Humisols)
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Deep Mesic (Fibric) Fen (Marl Limnic Fen)

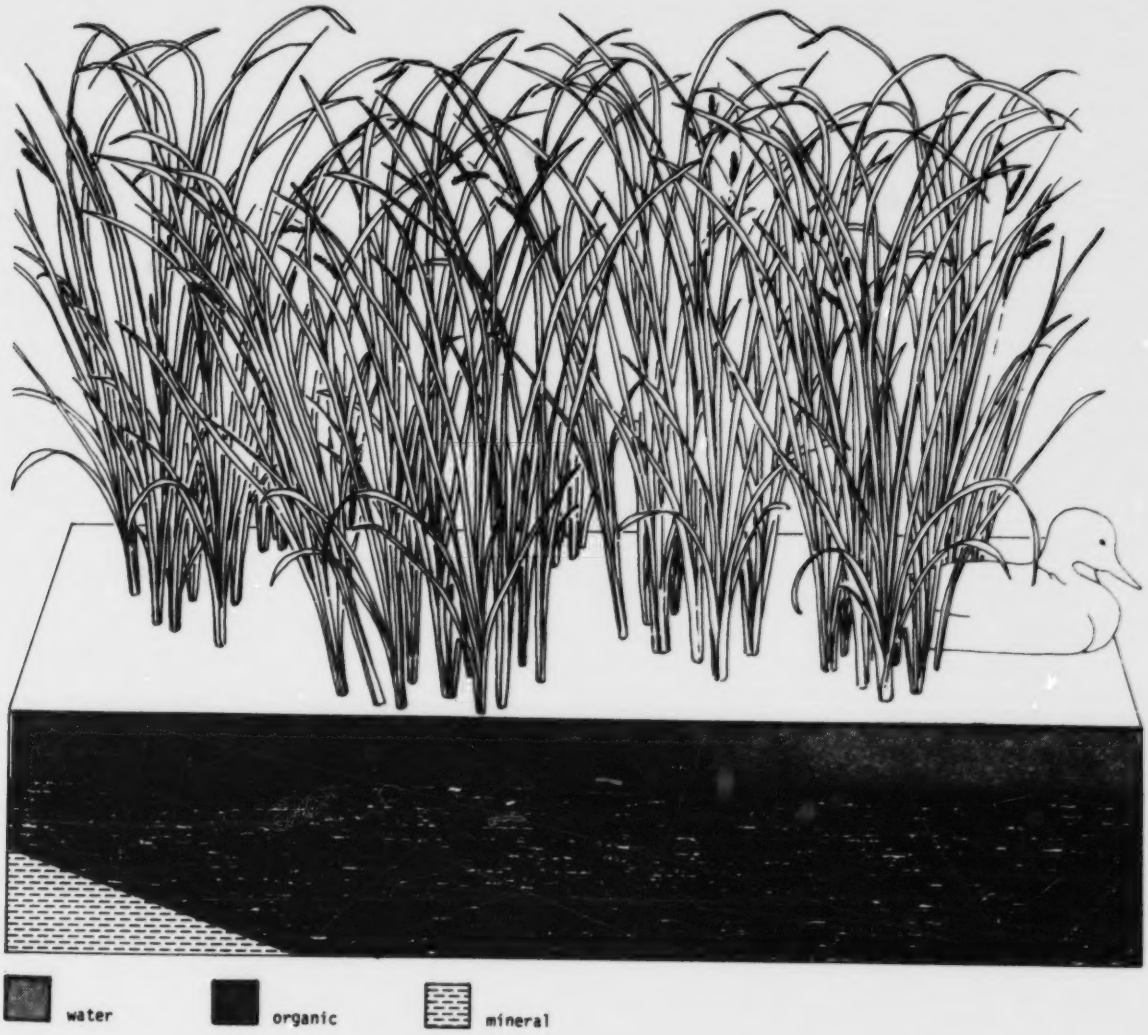
SITE/SOIL COMMENTS: These ecosystems are inundated (up to 40 cm) in early growing season, but standing water most often disappears by mid-August. Soil organic accumulations are usually greater than 50 cm over mineral soil. Mineral rich subsurface layers may be present. Organic materials are frequently carbonated. These fens are frequently managed for hay.

CHARACTERISTIC VEGETATION (by layer):

HERB	Beaked sedge	*Carex rostrata*
	Water sedge	*Carex aquatilis*
MOSS		*Drepanocladus aduncus*

VEGETATION COMMENTS: This ecosystem is characterized by a continuous cover of beaked sedge and water sedge. Stands are usually a mixture in which either species may be the dominant or, less frequently, one species occurs in pure stands. Northern mannagrass (*Glyceria borealis*) may be present in wetter microsites. Aquatic species (especially *Ranunculus* spp., *Myriophyllum* spp., *Utricularia* spp., and *Lemna* spp.,) and water smartweed (*Polygonum amphibium*) may also be present.

IDFb2/W9 BEAKED SEDGE - WATER SEDGE FEN ASSOCIATION
(Carex rostrata - Carex aquatilis Fen Association)



WETLAND SEQUENCE: This common wetland association is often in an interior position surrounded by a meadow and/or a shrub-carr border.

IDFb2/W10

ECOSYSTEM UNIT: SLENDER SEDGE - MOSS FEN ASSOCIATION
(*Carex lasiocarpa* - *Drepanocladus aduncus* Fen Association)

MOISTURE REGIME:	subhydric
SURFACE WATER:	seasonal, 0-30 cm
SUBSURFACE FREE WATER:	permanent to surface
HYDROTOPOGRAPHIC POSITION:	closed basin palustrine
SLOPE POSITION/SHAPE:	depression/straight
OCCURRENCE/SIZE:	uncommon/small
PARENT MATERIAL:	organic blanket
ORGANIC - DEPTH:	80 to 150+ cm
- DECOMPOSITION:	moderate
MINERAL SOIL TEXTURE:	N/A
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	65 (40-80) cm
SOIL CLASSIFICATION:	Typic Humisol Typic Mesisol
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Deep Mesic (Fibric) Fen

SITE/SOIL COMMENTS: These ecosystems are shallowly (< 30 cm) inundated in early growing season, but standing water usually disappears by mid-August. Soils remain saturated near the surface. Organic accumulations, derived primarily from mosses and sedges, are usually greater than 100 cm thick. Surface layers are rarely carbonated.

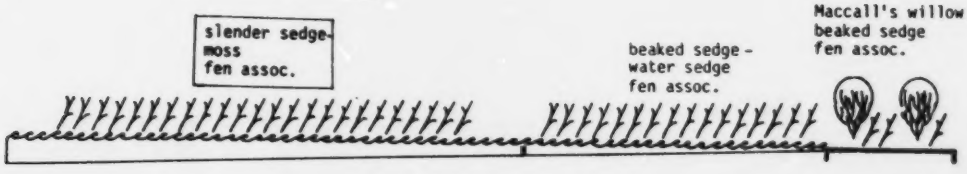
CHARACTERISTIC VEGETATION (by layer):

HERB	Slender sedge	*Carex lasiocarpa*
	Beaked sedge	*Carex rostrata*
	Water sedge	*Carex aquatilis*
	Seaside arrowgrass	*Triglochin maritimum*
MOSS		*Drepanocladus aduncus*

VEGETATION COMMENTS: This association has a low species diversity with the cover in the herb layer usually less than 50%. Slender sedge generally has a very even distribution with lesser amounts of beaked sedge and water sedge. Mosses have a high cover (80-100%).

IDFb2/W10 SLENDER SEDGE - MOSS FEN ASSOCIATION
(Carex lasiocarpa - Drepanocladus aduncus Fen Association)

WETLAND SEQUENCE: This association may occupy 50% of a wetland surrounded by a sedge fen and a tall shrub fen.



IDFb2/W11

ECOSYSTEM UNIT: BUCKBEAN - SLENDER SEDGE FEN ASSOCIATION
(*Menyanthes trifoliata* - *Carex lasiocarpa* Fen Association)

MOISTURE REGIME:	hydric
SURFACE WATER:	permanent, 20-60 cm
SUBSURFACE FREE WATER:	permanent to surface
HYDROTOPOGRAPHIC POSITION:	closed (linked) basin palustrine
SLOPE POSITION/SHAPE:	depression/straight
OCCURRENCE/SIZE:	uncommon/medium
PARENT MATERIAL:	organic
ORGANIC - DEPTH:	30-150+ cm
- DECOMPOSITION:	poor
MINERAL SOIL TEXTURE:	N/A
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	55 (30-70) cm
SOIL CLASSIFICATION:	Typic Fibrisol (Typic Mesisol, Hydric Fibrisol)
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Deep Fibric (Mesic) Fen (Floating Fen)

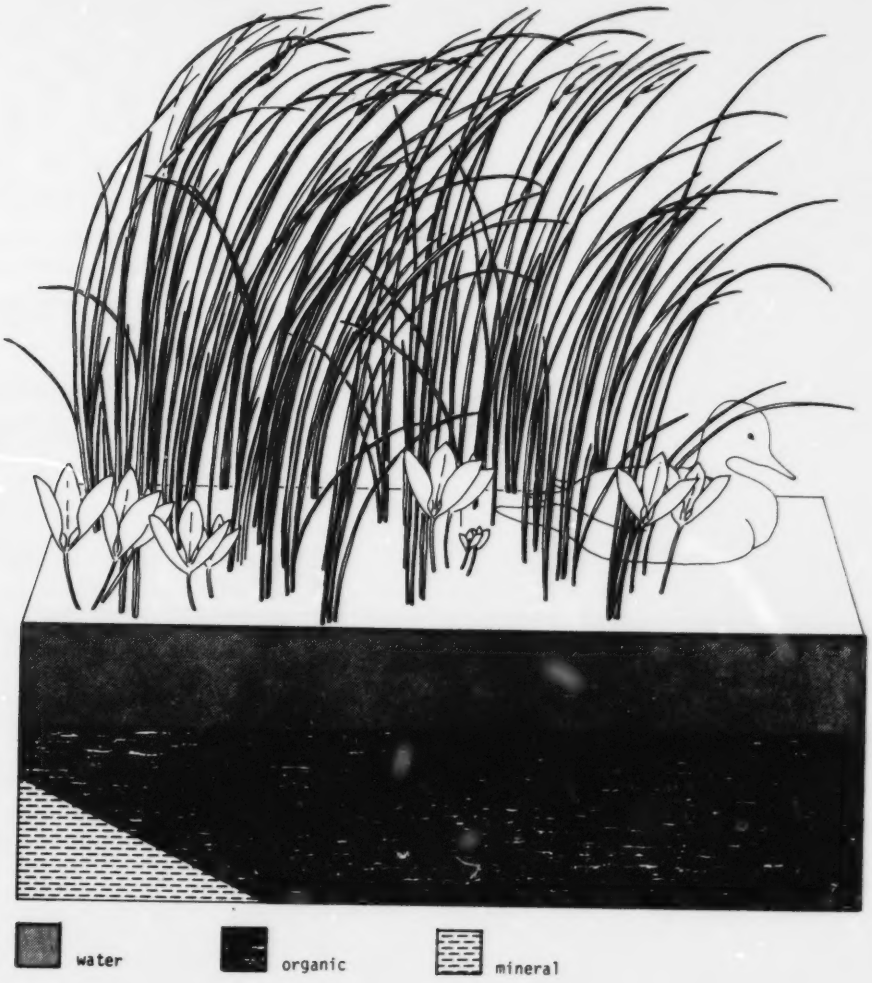
SITE/SOIL COMMENTS: These ecosystems are permanently inundated during most years. Soil organic accumulations are mostly greater than 50 cm thick. These ecosystems occasionally occur as floating fens.

CHARACTERISTIC VEGETATION (by layer):

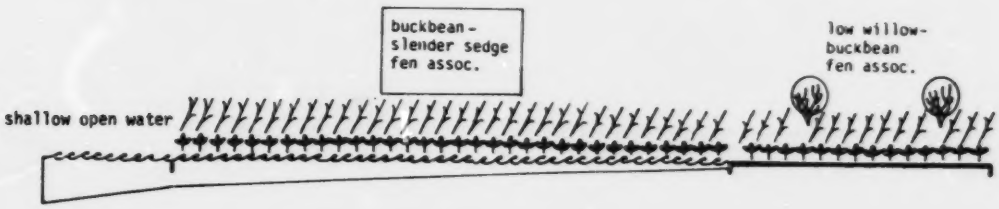
HERB	Buckbean	*Menyanthes trifoliata*
	Slender sedge	*Carex lasiocarpa*
	Shore sedge	*Carex limosa*
	Swamp horsetail	*Equisetum fluviatile*
MOSS		*Drepanocladus aduncus*

VEGETATION COMMENTS: Slender sedge and buckbean dominate the herb layer in even distribution throughout this ecosystem. Swamp horsetail and seaside arrowgrass (*Triglochin maritimum*) may also be present. Moss cover is 75-95%.

IDFb2/W11 BUCKBEAN - SLENDER SEDGE FEN ASSOCIATION
(Menyanthes trifoliata - Carex lasiocarpa Fen Association)



WETLAND SEQUENCE: This association frequently covers 80-95% of a wetland with some open water in the centre and a border of low shrub fen.



IDFb2/W12

ECOSYSTEM UNIT: ARROWGRASS MARSH ASSOCIATION
(Triglochin maritimum Marsh Association)

MOISTURE REGIME:	hydric
SURFACE WATER:	seasonal (permanent), 0-60 cm
SUBSURFACE FREE WATER:	permanent to surface
HYDROTOPOGRAPHIC POSITION:	linked basin palustrine
SLOPE POSITION/SHAPE:	level/straight
OCCURRENCE/SIZE:	uncommon/small
PARENT MATERIAL:	organic veneer over silty lacustrine blanket
ORGANIC - DEPTH:	25-50 cm
- DECOMPOSITION:	moderate to poor
MINERAL SOIL TEXTURE:	silt loam and silty clay loam
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	50 cm
SOIL CLASSIFICATION:	Orthic Gleysol (Fibrisol)
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Saline Shallow Marsh

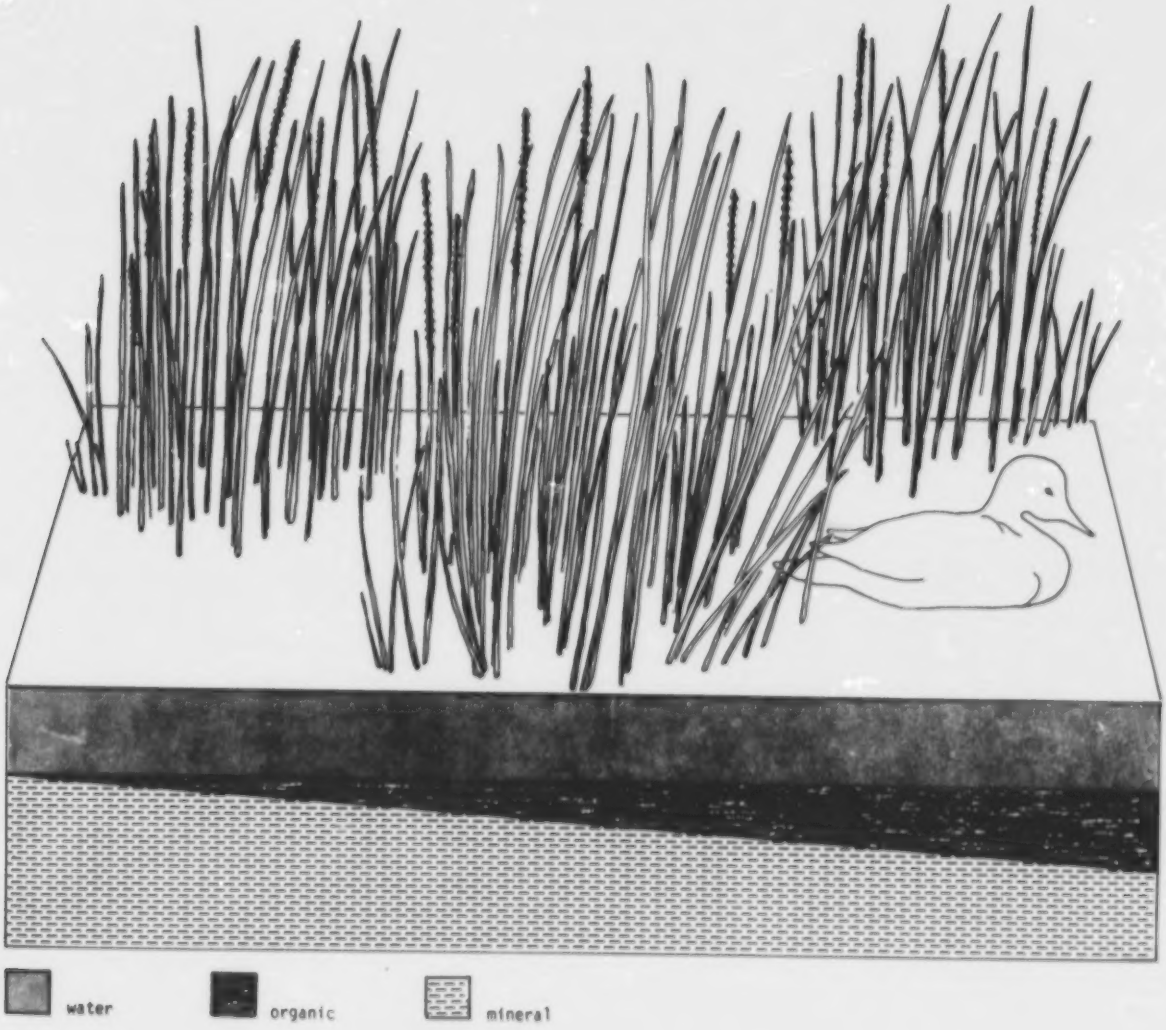
SITE/SOIL COMMENTS: These ecosystems are most often seasonally inundated although standing water may remain until late August. Soil organic accumulations are mostly 25-50 cm thick and mineral-rich. Surface materials are usually strongly carbonated. These ecosystems usually occur in small patches.

CHARACTERISTIC VEGETATION (by layer):

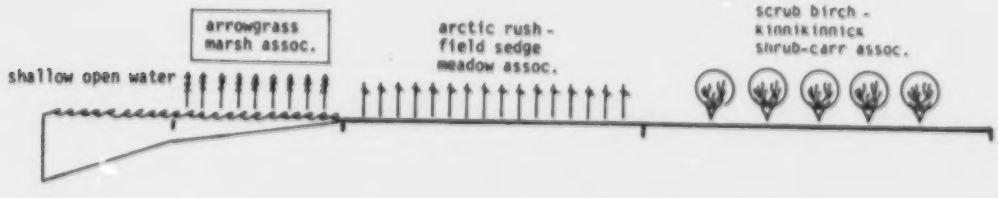
HERB	Seaside arrowgrass	Triglochin maritimum

VEGETATION COMMENTS: Very low species diversity, often with just the single species, seaside arrowgrass, being present. Aquatics such as greater bladderwort (Utricularia vulgaris) and mares-tail (Hippuris vulgaris) may occur.

IDFb2/W12 ARROWGRASS MARSH ASSOCIATION
(Triglochin maritimum Marsh Association)



WETLAND SEQUENCE: This association usually occupies less than 30% of a wetland. There may be open water or a cattail marsh on the wetter side, with a meadow and a shrub-carr on the drier side.


arrowgrass marsh assoc.
arctic rush - field sedge meadow assoc.
scrub birch - Kinnikinnick shrub-carr assoc.
shallow open water

IDFb2/W13

ECOSYSTEM UNIT: CATTAIL MARSH ASSOCIATION
(*Typha latifolia* Marsh Association)

MOISTURE REGIME:	hydric
SURFACE WATER:	permanent (seasonal), 0-100 cm
SUBSURFACE FREE WATER:	permanent to surface
HYDROTOPOGRAPHIC POSITION:	closed basin palustrine or stream riverine
SLOPE POSITION/SHAPE:	depression/concave
OCCURRENCE/SIZE:	uncommon/small
PARENT MATERIAL:	lacustrine blanket or organic veneer over lacustrine blanket
ORGANIC - DEPTH:	0-15 cm
- DECOMPOSITION:	well
MINERAL SOIL TEXTURE:	silty clay loam
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	30 cm
SOIL CLASSIFICATION:	Orthic Gleysol (Terric Humisol)
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Deep (Shallow) Marsh

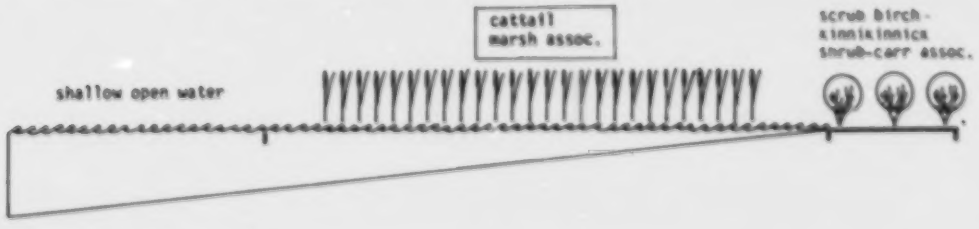
SITE/SOIL COMMENTS: These marsh ecosystems usually occur in very small patches at the edge of small streams, ponds, or lakes. Most are deep marshes that are permanently inundated although very small seasonal marshes also occur.

CHARACTERISTIC VEGETATION (by layer):

HERB	Cattail	*Typha latifolia*
	Whorled water-milfoil	*Myriophyllum verticillatum*
	Greater bladderwort	*Utricularia vulgaris*
	Great duckweed	*Spirodela polyrhiza*

VEGETATION COMMENTS: Cattail is the dominant emergent vegetation. Aquatics, (especially *Myriophyllum* spp., *Utricularia* spp., and *Lemna* spp.) are usually present. Other vegetation may be rooted in floating mats of moss (*Drepanocladus* sp.).

WETLAND SEQUENCE: A cattail marsh may cover 95% of a wetland with a narrow border of shrubs, or there may only be a few clumps of cattail within an area of shallow open water.



IDFb2/W13 CATTAIL MARSH ASSOCIATION
(Typha latifolia Marsh Association)

IDFb2/W14

ECOSYSTEM UNIT: GREAT BULRUSH MARSH ASSOCIATION
(Scirpus lacustris Marsh Association)

MOISTURE REGIME:	hydric
SURFACE WATER:	permanent (seasonal), 0-150 cm
SUBSURFACE FREE WATER:	permanent to surface
HYDROTOPOGRAPHIC POSITION:	closed (linked) basin (lowland) palustrine
SLOPE POSITION/SHAPE:	depression/concave
OCCURRENCE/SIZE:	common/small to medium
PARENT MATERIAL:	silty lacustrine blanket (organic veneer)
ORGANIC - DEPTH:	0-25 (100) cm
- DECOMPOSITION:	well
MINERAL SOIL TEXTURE:	silty clay loam
SOIL DRAINAGE:	very poor
ROOTING DEPTH:	50 cm
SOIL CLASSIFICATION:	Orthic Gleysol (Typic Humisol)
WETLAND CLASSIFICATION (RUNKA and LEWIS 1981):	Saline Deep (Shallow) Marsh

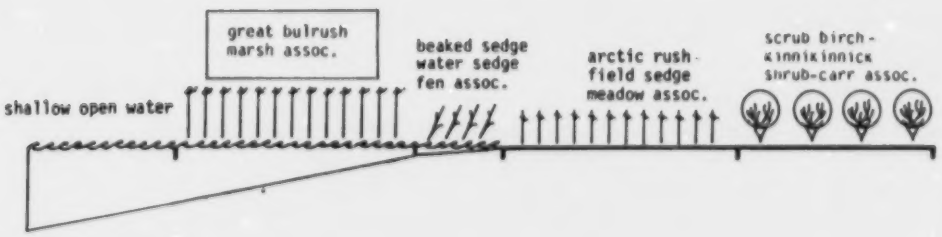
SITE/SOIL COMMENTS: These marshes are usually found surrounding open water; they are most often permanently inundated. The soil is a mixture of fine-textured mineral sediments and organic material. Surfaces are often carbonated. Organic accumulations are 0 to over 25 cm thick. Shells are frequently present in the soil.

CHARACTERISTIC VEGETATION (by layer):

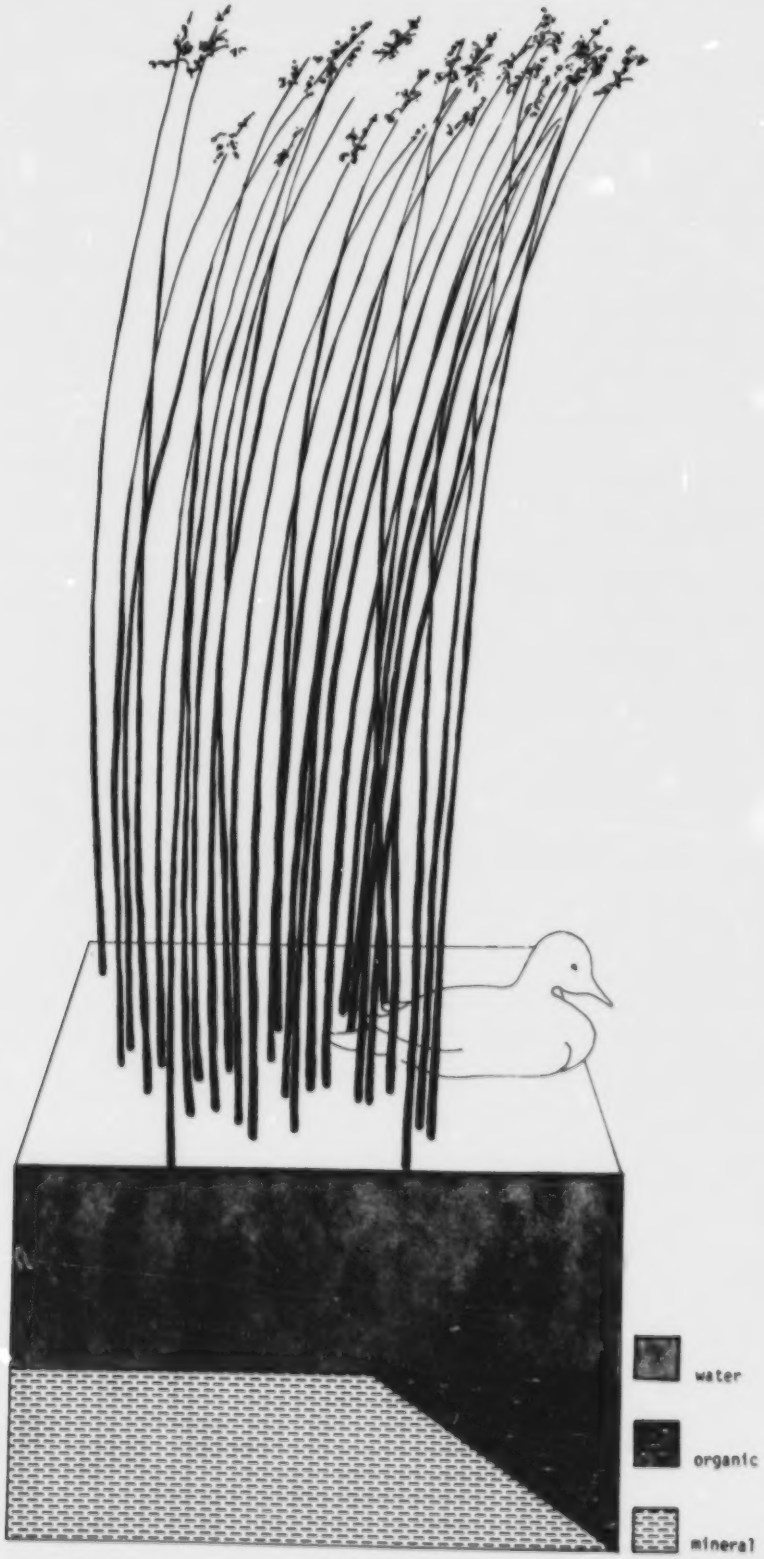
HERB	Great bulrush	Scirpus lacustris

VEGETATION COMMENTS: Typically this association is a pure stand of great bulrush. Aquatics, notably greater bladderwort (Utricularia vulgaris), are often present.

WETLAND SEQUENCE: The bulrush marsh usually occupies more than 20% of a wetland and occurs in bands surrounding open water. It is frequently bordered by a narrow band of sedge fen in the transition to a drier meadow.


great bulrush marsh assoc.
beaked sedge water sedge fen assoc.
arctic rush - field sedge meadow assoc.
scrub birch - kinnikinnick shrub-carr assoc.
shallow open water

IDFb2/W14 GREAT BULRUSH MARSH ASSOCIATION
(Scirpus lacustris Marsh Association)



4.3 Management Interpretations Summaries

Range and wildlife habitat management interpretation summaries are presented in the following tables. These interpretations attempt to summarize the experience and knowledge of range and wildlife habitat managers within the framework of the wetland ecosystem classification. The interpretations are preliminary and will be amended and improved as the classification is used to organize information regarding management of wetland ecosystems.

Equipment and techniques for agricultural development of organic wetlands in British Columbia are described by Central Interior Forage Extension Committee (1981).

It is not the intention of this guide to attempt to resolve land use conflicts or necessarily to promote one land use over another on a particular ecosystem unit. Rather, the ecosystem classification and interpretations provide an ecological framework and guide for making specific land use decisions.

TABLE 1. Range Management interpretations for wetland ecosystem units of the IDFb2 in the Cariboo Forest Region

Ecosystem unit	Significant native forage	Carrying capacity (ha/aum)	Enhancement Opportunities[a]	Management/Use Constraints	Comments
IDFb2/W1 Alkali saltgrass Nuttall's alkaligrass Meadow	Nuttall's alkaligrass	2.5 + ha	few practical; discing and seeding with salt-tolerant grasses may increase production	high salinity levels and sparse vegetation reduce range value and management options	little forage production potential; little used for grazing
IDFb2/W2 Nuttall's alkaligrass-Foxtail barley Meadow	Nuttall's alkaligrass, foxtail barley, alkali bluegrass	2.0 - 2.5 ha	discing and seeding with salt-tolerant grasses may increase production	high salinity levels reduce range values; foxtail barley awns reduce palatability by early July	spring burning will reduce previous years' foxtail barley heads; grazing should be early before foxtail barley heads out; this unit usually grazed in conjunction with IDFb/W3
IDFb2/W3 Arctic rush - Field sedge Meadow	field sedge, slender wheatgrass, Nuttall's alkaligrass foxtail barley	1.5 - 2.0 ha	seeding with suitable salt-tolerant grasses may increase production; if foxtail barley is abundant, spring burning will reduce previous years' heads	foxtail barley awns may reduce palatability after early July	usually grazed in conjunction with IDFb/W2
IDFb2/W4 Scrub birch - Kinnikinnick Shrub-Carr	slender wheatgrass, field sedge plus a variety of other grasses, sedges and forbs	0.5 - 2.5 ha	forage production may be increased by shrub clearing and burning and possibly by seeding	wildlife values should be considered prior to shrub clearing and burning	these shrub-carrs are often adjacent to timbered range; used season-long as resting areas and travel corridors between other wetland units
IDFb2/W5 Maccall's willow - Beaked sedge Fen	water sedge, beaked sedge	0.5 - 0.8 ha	range value may be improved by spring burning to reduce old sedge growth; forage production may be increased by shrub clearing	most sites are small; early grazing limited by standing water; wildlife values should be considered prior to shrub clearing and burning	usually used in conjunction with unit IDFb2/W9; used for winter rustling by cattle from October to late December (with protein supplement); high wildlife potential
IDFb2/W6 Tall willow - Sartwell's sedge Swamp	beaked sedge, water sedge, Sartwell's sedge, fowl mannagrass	1.0 - 1.5 ha	none practical for range use	areas generally too small to manage for cattle use	used by cattle for shelter and resting and possibly for fall and winter rustling; travel through this unit may be difficult due to high shrub densities; may be important wildlife habitat
IDFb2/W7 Low willow - Buckbean Fen	slender sedge, water sedge, buckbean	0.5 - 0.8 ha.	spring burning and seeding may substantially increase forage production; possibility for water control and haying	early grazing limited by standing water; arrowgrass is often present, resulting in potential toxicity problems	these sites are often close to open water; little used in summer, used mostly for fall and winter grazing by cattle and horses (with protein supplement)

TABLE 1. Continued

Ecosystem unit	Significant Native Forage	Carrying Capacity (ha/aum)	Enhancement Opportunities [a]	Management/Use Constraints	Comments
IDFb2/W8 Awned sedge	awned sedge, sloughgrass	0.5 - 0.8 ha.	none practical due to typically small size of unit; burning or haying may improve palatability	early-season grazing limited by standing water	grazing values highest during late summer and fall
IDFb2/W9 Beaked sedge-Water sedge Fen	beaked sedge, water sedge	0.3 - 0.5 ha.	spring burning may improve forage palatability and production; haying may improve palatibility; possiblity for water control	early to mid season grazing limited by standing water	typically occurs in large wetland complexes; high value for fall and early winter grazing (with supplemental feeding) for cattle and horses; grasses may increase with grazing; an important range resource; commonly hayed
IDFb2/W10 Slender sedge - Moss Fen	slender sedge, beaked sedge, water sedge	0.5 - 0.8 ha.	possibility for water control and haying; haying may improve palatability	same as IDFb2/W9	good value for fall and early winter grazing (with supplemental feeding) by cattle and horses; arrowgrass may be present resulting in toxicity problems
IDFb2/W11 Buckbean - Slender sedge Fen	slender sedge, shore sedge, buckbean	0.8 - 1.0 ha.	none practical	grazing values limited by permanent standing water	cattle may use edges
IDFb2/W12 Arrowgrass Marsh	none	carrying capacity nil	none practical; usable range may be created by draining and discing followed by planting of competitive species	arrowgrass toxicity; occurrence of this association may limit grazing use of area, especially in spring and fall	livestock should be fenced out of this association; arrowgrass toxicity is high when new growth is present
IDFb2/W13 Cattail Marsh	none	carrying capacity nil	none practical	no usable forage	--
IDFb2/W14 Great Bulrush Marsh	none	carrying capacity nil	none practical	no usable forage	--

[a] For seeding, consult Range Agrologist or District Agriculturalist regarding suitable species, varieties, and methods.

Table 2. Wildlife habitat management interpretations for wetland ecosystem units of the IDFb2, Cariboo Forest Region

ECOSYSTEM ASSOCIATION	VALUE[a] TO SPECIES GROUPS: MOOSE	MULE DEER	BLACK BEAR	FUR-BEARERS	UPLAND GAME BIRDS	WATERFOWL	AMPHIBIANS	REPTILES	NON-GAME BIRDS	NON-GAME MAMMALS	WILDLIFE HABITAT COMMENTS	HABITAT PROTECTION CONSIDERATIONS
IDFb2/W1 Alkali saltgrass - Nuttall's alkaligrass Meadow	N	L	N	V	N	V	V	V	M-H	M-H	-seasonal use by wildlife increased when adjacent to shallow open water	- wildlife habitat values most sensitive to livestock use and other site disturbance from mid-April to late June; avoid disturbance during this period
IDFb2/W2 Nuttall's alkaligrass - Foxtail barley Meadow	N	M	M	V	L	L-M	V	V	M-H	M-H	-spring range for deer and bear -nesting habitat for waterfowl	- same as IDFb2/W1 - adequate vegetation should be maintained for nesting cover
IDFb2/W3 Arctic rush - Field sedge Meadow	N	M	M	V	L	L-M	V	V	M-H	M-H	-same as IDFb2/W2	- Same as IDFb2/W1
IDFb2/W4 Scrub birch - Kinnikinnick Shrub-carr	M	L-M	L	L	H	N	V	V	H	H	-provides habitat requirements (nesting, cover, feeding) for many species -provides good edge adjacent to timber -low shrubs minimize need for habitat enhancement	- shrub cover important for maintenance of wildlife habitat values; avoid clearing or other significant disturbance of shrubs - winter rustling by livestock may jeopardize habitat values for several species

Table 2. (Continued)

ECOSYSTEM ASSOCIATION	VALUE[a] TO SPECIES GROUPS: MOOSE	MULE DEER	BLACK BEAR	FUR-BEARERS	UPLAND GAME BIRDS	WATERFOWL	AMPHIBIANS	REPTILES	NON-GAME BIRDS	NON-GAME MAMMALS	WILDLIFE HABITAT COMMENTS	HABITAT PROTECTION CONSIDERATIONS
IDFb2/W5 Mccall's willow - Beaked sedge Fen	H	M	M	V	L	L	V	V	M-H	M	-important moose habitat -possible habitat enhancement by selective cutting or knock-down of tall (over 3m) willows to encourage sprouting	- winter rustling by livestock will jeopardize important wildlife habitat values; - avoid agricultural development and water table manipulation
IDFb2/W6 Tall willow - Sartwell's Sedge Swamp	H	M	M	H	M	M	V	V	M-H	M-H	-provides excellent riperian habitat for many wildlife species -possible habitat enhancement by selective cutting of tall (over 3m) willows to encourage sprouting, maintain a cover of tall shrubs -often adjacent to fish habitat	- significant livestock use will jeopardize important wildlife habitat values; - avoid agricultural development and ground water level manipulation
IDFb2/W7 Low willow - Buckbean Fen	M	N-L	L	L-M	N	L	V	V	V	L	-may provide excellent nesting habitat for some waterfowl species, especially when adjacent to shallow open water	- winter rustling by livestock and disturbances to shrubs will jeopardize important wildlife habitat values - minimize water table manipulation
IDFb2/W8 Awned sedge Fen-Marsh	L	N-L	L	H	L	H	V	V	H	L	-important waterfowl habitat	- agricultural development and livestock grazing will jeopardize important wildlife habitat values; - avoid water table manipulation

Table 2. (Continued)

ECOSYSTEM ASSOCIATION	VALUE[a] TO SPECIES GROUPS: MOOSE	MULE DEER	BLACK BEAR	FUR-BEARERS	UPLAND GAME BIRDS	WATERFOWL	AMPHIBIANS	REPTILES	NON-GAME BIRDS	NON-GAME MAMMALS	WILDLIFE HABITAT COMMENTS	HABITAT PROTECTION CONSIDERATIONS
IDFb2/W9 Beaked sedge - Water sedge Fen	L	N-L	L	M	N-L	M	V	V	H	N-L	-waterfowl values are greatest where close to open water -may be used for nesting habitat by non-game birds -beaked sedge seed is a source of food for both birds and small mammals	- wildlife habitat values may not be significantly jeopardized by agricultural development or livestock use
IDFb2/W10 Slender sedge - Moss Fen	L	N-L	L	M	N-L	M	V	V	H	N-L	-Same as IDFb2/W9	- same as IDFb2/W9
IDFb2/W11 Buckbean - Slender sedge Fen	L	N-L	L	M-H	L	H	V	V	H	L	-may be important habitat for waterfowl reproduction and feeding	- water level fluctuations may affect waterfowl reproduction and feeding - minimize disturbance of this association
IDFb2/W12 Arrowgrass Marsh	L	N-L	L	H	L	H	V	V	H	L	-same as IDFb2/W11	- same as IDFb2/W11
IDFb2/W13 Cattail Marsh	L	N-L	L	H	L	H	V	V	H	L	-same as IDFb2/W11	- same as IDFb2/W11
IDFb2/W14 Great bulrush Marsh	L	N-L	L	H	L	H	V	V	H	L	-same as IDFb2/W11	- same as IDFb2/W11

[a] Value: N = Nil; L = Low; M = Moderate; H = High; V = Variable (depending on species or site specific features)

4.4 Relation of Ecosystem Associations to Other Wetland Classifications

Other ecological wetland classification schemes that are available to wetland managers in the Cariboo Forest Region include those developed by Runka and Lewis (1981), the National Wetlands Working Group (Tarnocai 1980), and Moon and Selby (1982). The relation of the wetland ecosystem units in this report to the wetland types defined by Runka and Lewis (1981) is indicated in the ecosystem unit descriptions and is summarized in Table 3. Only one ecosystem association (Awned sedge fen-marsh) did not fit easily within one of the Runka and Lewis wetland classes. At lower levels, however, the correlation between the ecosystem associations defined here and the wetland subclass and wetland variant levels of Runka and Lewis is less evident. For example, some ecosystem associations occur in two (and occasionally three) subclasses, while others are found in only one subclass. In many cases, insufficient data were available especially on wetland chemistry, to classify the ecosystem association according to subclass or variant. Rather, greater emphasis has been given to vegetation as an indicator of ecosystem characteristics. Whenever possible, however, the wetland subclass(es) and wetland variant(s) to which an association belongs are indicated in the descriptions.

The National Wetlands Working Group has established a Canadian wetland registry to provide a basis for uniform data collection and comparison from wetlands across Canada (Tarnocai 1980). Regional differences in the development of wetlands are recognized by distinguishing 18 wetland regions in Canada. Three levels of classification are included in the registry. The wetland classes (bog, fen, etc.) are largely synonomous in concept with the wetland classes described by Runka and Lewis (1981) and used to group ecosystem associations in this guide. However, the definition of wetlands in the registry does not encompass the relatively dry meadow and shrub-carr ecosystems found in the Cariboo Forest Region and, as a result, no classification is provided for these wetlands. Each wetland class in the registry is subdivided into wetland forms on the basis of characteristics such as surface morphology and type of water. Each form is further subdivided into wetland type according to general physiognomy of the vegetation cover (coniferous, tall shrub, grass, etc.). The classification of ecosystem associations in this guide in terms of the national classification scheme is indicated on Table 3.

Moon and Selby (1982) have defined several wetland systems that occur in the Cariboo - Chilcotin region. Each system represents a diagnostic sequence of wetland vegetation and soil types that can be used to classify an entire wetland area. Thus the wetland system is a landscape classification in which each unit includes one or more of the classes of Runka and Lewis (1981) or associations of this guide.

Table 3. Classification of wetland ecosystem units of the IDFb2, Cariboo Forest Region, according to the "Preliminary Wetland Manager's Manual" (Runka and Lewis 1981) and the National Wetland Registry (Tarnocai 1980)

	Runka and Lewis (1981) Unit Name	Tarnocai (1980) Unit Name
Alkali saltgrass - Nuttall's alkaligrass Meadow	Saline Mineral Meadow	----------
Nuttall's alkaligrass - Foxtail barley Meadow	Saline Mineral Meadow	----------
Arctic rush - Field sedge Meadow	Saline Mineral Meadow	----------
Scrub birch - Kinnikinnick Shrub-Carr	Saline Mineral Shrub Carr	----------
Mccall's willow - Beaked sedge Fen	Deep Mesic Fen	Tall Shrub Horizontal Fen
Tall willow - Sartwell's sedge Swamp	Shrub Organic Swamp (Shrub Mineral Swamp)	Tall Shrub Stream Swamp
Low willow - Buckbean Fen	Deep Fibric Fen (Deep Mesic Fen)	Sedge Horizontal Fen (Low Shrub Horizontal Fen)
Awned sedge Fen-Marsh	Shallow Marsh Humic Fen (Deep Marsh) (Limnic Fen)	Sedge Terminal Basin Marsh Sedge Shallow Basin Marsh (Sedge Horizontal Fen) (Sedge Horizontal Fen)
Beaked sedge - Water sedge Fen	Deep Mesic Fen (Deep Fibric Fen) (Marl Limnic Fen)	Sedge Horizontal Fen
Slender sedge - Moss Fen	Deep Mesic Fen (Deep Fibric Fen)	Sedge Horizontal Fen (Sedge Shore Fen)
Buckbean - Slender sedge Fen	Deep Fibric Fen (Floating Fibric Fen) (Deep Mesic Fen)	Sedge Shore Fen (Sedge Floating Fen)

TABLE 3. (Continued)

	Runka and Lewis (1981) Unit Name	Tarnocai (1980) Unit Name
Seaside arrowgrass Marsh	Saline Shallow Marsh	Mixed Forb Shallow Basin Marsh
Cattail Marsh	Deep Marsh (Shallow Marsh)	Rush Terminal Basin Marsh Rush Shallow Basin Marsh Rush Stream Marsh
Great bulrush Marsh	Saline Deep Marsh (Saline Shallow Marsh)	Rush Terminal Basin Marsh Rush Shore Marsh (Rush Shallow Basin Marsh)

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APPENDIX 1. A Guide to common wetland plant species of the Very Dry Montane Interior Douglas-Fir Subzone Eastern Fraser Plateau Variant (IDFb2)

This guide includes species common in non-forested wetlands of the Very Dry Montane Interior Douglas-fir subzone, Eastern Fraser Plateau Variant (IDFb2). All species mentioned in the descriptions of the IDFb2 wetland ecosystem units (except hybrid white spruce) are included in this plant guide.

The sequence of species in this guide is organized by growth form class (shrubs, grasses, grass-like plants, forbs, and mosses). Within each class, species which are morphologically most similar, and thus most easily confused, are placed together for purposes of comparison.

The nomenclature used follows that of Taylor and MacBryde (1977).

A list of reference sources used for botanical descriptions of these wetland species is contained in Appendix 3.

SCRUB BIRCH
Betula glandulosa

FORM: low shrub, spreading to erect, mostly 1-2 m tall

BRANCHES: resinous with wart-like crystalline glands

LEAVES: usually 1-2 cm across; nearly circular; round toothed, somewhat thick and leathery, glandular on both surfaces, bright green, turning deep orange in the fall

CATKINS: flowering with the appearance of leaves in spring

HABITAT: common in wetlands that have no standing water late in the season

MACKENZIE'S WILLOW
Salix mackenzieana

FORM: shrub up to 4 m or more tall

BRANCHES: reddish brown, glossy; twigs reddish-brown to yellow-green

LEAVES: ovate-lanceolate; margins finely toothed; immature leaves reddish; stipules prominent

CATKINS: appearing shortly before the leaves, on short leafy shoots; capsules smooth (a)

HABITAT: a common species of tall shrub fens and swamps

MACCALL'S WILLOW
Salix maccalliana

FORM: shrub 1-4 m tall

BRANCHES: dark reddish brown, glossy; twigs bright red in spring

LEAVES: leathery, with a stout yellowish midrib, bright green above, pale green below; margin toothed

CATKINS: appearing with the leaves, on long leafy shoots; capsules white woolly (a)

HABITAT: a common species of shrubby fens

GREY-LEAVED WILLOW
Salix glauca

FORM: shrub .5-3 m tall

BRANCHES: dull greyish; twigs densely to sparsely hairy

LEAVES: pale green above, whitish beneath, greyish-hairy when young, margins entire

CATKINS: appearing with the leaves on short leafy shoots; capsules white woolly (a)

HABITAT: widespread in wetlands

SHORT-FRUITED WILLOW
Salix brachycarpa

FORM: low shrub, usually less than 1 m high

BRANCHES: twigs slender, densely white hairy

LEAVES: small, densely hairy on both sides, margins entire, petiole short

CATKINS: appearing with the leaves on short leafy shoots; capsules white woolly (a)

HABITAT: common in shrub-carrs

TEA-LEAVED WILLOW
Salix planifolia

FORM: up to 4 m or more tall

BRANCHES: dark brown to reddish brown; twigs smooth to densely hairy

LEAVES: elliptic to narrowly so, green and shiny above with a whitish waxy covering beneath; veins closely spaced and parallel; margin mostly subentire to remotely toothed

CATKINS: appearing before the leaves, sessile on previous years branches; capsules hairy (a)

HABITAT: common in tall shrub fens and swamps

HOARY WILLOW
Salix candida

FORM: low shrub, .3-1.5 m tall

BRANCHES: dark brown; twigs white woolly

LEAVES: long and narrow, lower surface densely white woolly; margins without teeth, revolute

CATKINS: appearing wih the leaves on short, leafy shoots; capsules white woolly (a)

HABITAT: a common low shrub in fens

BOG WILLOW
Salix pedicellaris

FORM: small shrub up to 1.5 m tall, rooting in moss

BRANCHES: grey-brown, smooth; twigs reddish-brown

LEAVES: small, narrow, margins entire; both surfaces smooth with a bluish waxy covering giving the foliage a bluish-green colour

CATKINS: appearing with the leaves on short leafy shoots; capsules reddish, smooth (a)

HABITAT: a common low shrub in fens

KINNIKINNICK
Arctostaphylos uva-ursi

FORM: dwarf evergreen shrub, often forming mats with long flexible branches

LEAVES: oval to spatula shaped, leathery, entire, dark green, somewhat shiny above, paler beneath, to 2.4 cm long

FLOWERS: tiny, bell-shaped, pinkish to white flowers form a dense cluster; fruit a red berry

HABITAT: common in shrub-carrs

MAT MUHLY
Muhlenbergia richardsonis

FORM: low, matted perennial with short rhizomes; stems wiry, 5-30 cm high

LEAVES: narrow, 1-1.5 mm broad

INFLORESCENCE: panicle narrow and spikelike; single floret to the spikelet; glumes about 1 mm long

HABITAT: common in meadows and shrub-carrs, often where alkaline. Not readily grazed

ALKALI SALTGRASS
Distichlis stricta

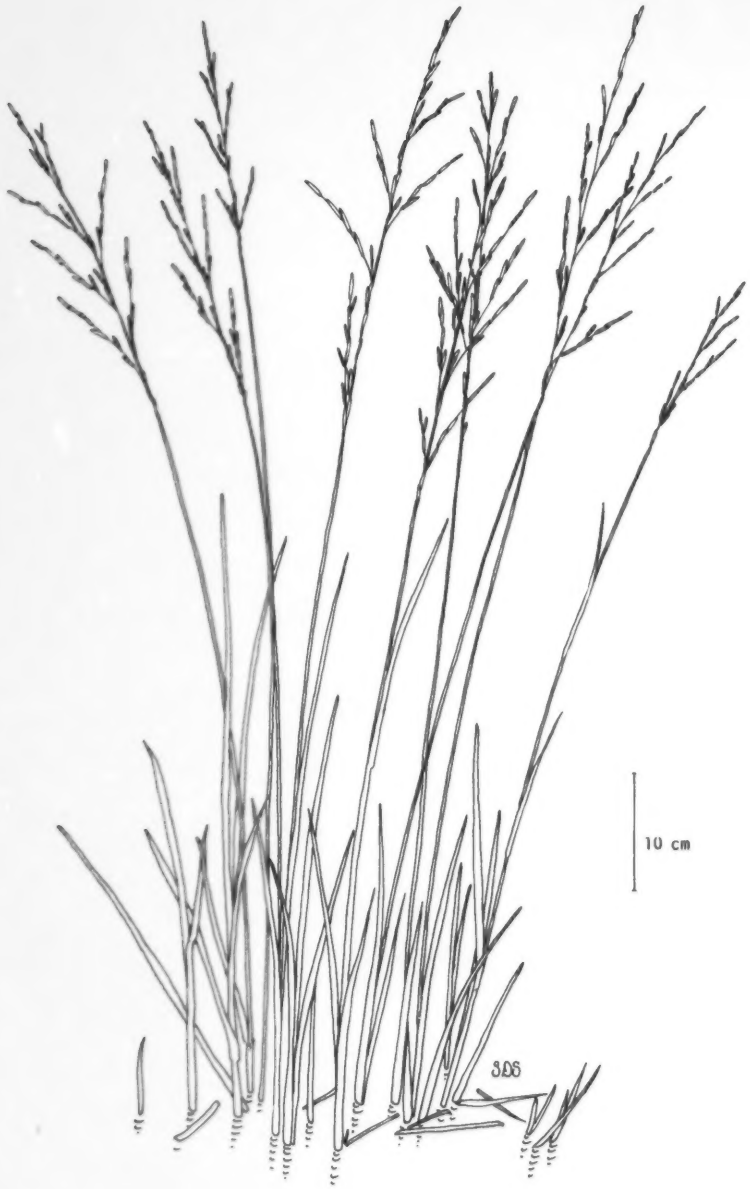
FORM: a native, sod-forming short grass with vigorous, scaly rhizomes

LEAVES: yellowish-green, short and stiff; old leaves persistant

INFLORESCENCE: panicle small with large, compressed spikelets; male and female flowers form on separate plants

HABITAT: saline or alkaline meadows, occasionally on dry slopes

NOTES: a distinctive grass that may form a uniform cover over large areas. It is rather harsh and tough for good pasturage



NORTHERN MANNAGRASS
Glyceria borealis

FORM: up to 1 m tall, strongly rhizomatous

LEAVES: numerous, 3-5 mm broad

INFLORESCENCE: panicle large, up to 45 cm long, erect; spikelets cylindrical, over 1 cm long; lemmas striated; spikelets shed out early leaving "green stick-like" appearance

HABITAT: fens and marshes, often in shallow standing water

NOTES: utilized by livestock.

FOWL MANNAGRASS
Glyceria striata

FORM: rhizomatous, 30-80 cm tall

LEAVES: mostly erect, 2-5 mm broad; ligules usually closed in front

INFLORESCENCE: panicle loose with slender branches; glumes very small; lemmas striated, barely 2 mm long (a)

HABITAT: scattered in wet meadows, marshes, fens and swamps

NOTES: utilized by livestock. A similar species, G. elata, has wider leaves (6-12 mm) with ligules open in front

NUTTALL'S ALKALIGRASS
Puccinellia nuttalliana

FORM: tufted perennial, 40-80 cm tall

LEAVES: smooth, short, becoming folded

INFLORESCENCE: panicle spreading, 6-20 cm long; spikelets 4 to 7-flowered; glumes small; lemmas narrowed to an obtuse tip

HABITAT: wetland meadows, usually where alkaline

NOTES: this grass furnishes considerable forage in wetlands where it is common; often found growing with alkali saltgrass (Distichlis stricta)

FOXTAIL BARLEY
Hordeum jubatum

FORM: tufted, 30-60 cm tall, stem erect or bent at base

LEAVES: greyish-green, rough, less than 5 mm wide

INFLORESCENCE: spike usually nodding; glumes awn-like, 2-6 cm long; lemmas with equally long awns

HABITAT: moist open ground, meadows; increasing with slight disturbance

NOTES: easily recognized by the "foxtail" of long purplish awns; this attractive grass has little forage value because the rough awns can cause irritation to grazing animals

SLENDER WHEATGRASS
Agropyron trachycaulum

FORM: slender, loosely tufted perennial, 50-90 cm tall

LEAVES: scabrous, usually flat; several along stem

INFLORESCENCE: spike slender, 8-20 cm long; spikelets overlapping, from less than 2, to 2.5 times as long as the internode

HABITAT: widespread in shrub-carrs, meadows, grassland and open forest on moist to well-drained soils

NOTES: this is a variable species that has been divided into several distinct varieties. Slender wheatgrass is considered excellent forage for livestock

KENTUCKY BLUEGRASS
Poa pratensis

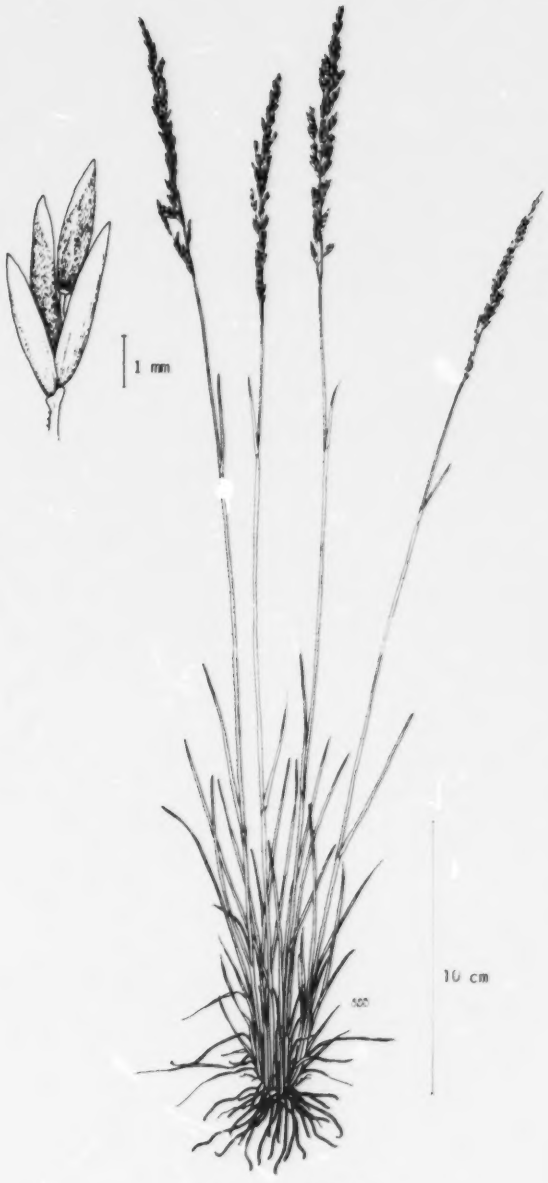
FORM: erect, with long creeping rhizomes, forming a dense sod

LEAVES: flat to folded, numerous, with distinct boat-shaped tips

INFLORESCENCE: panicle open, pyramid-shaped, usually with 3-5 branches at each joint; lemmas webbed at base

HABITAT: introduced and commonly seeded for pasture and for lawns

NOTES: this grass is highly tolerant of close grazing, has good palatability, and is of value to both domestic stock and wildlife



ALKALI BLUEGRASS
Poa juncifolia

FORM: tall, strongly tufted, often forming large clumps

LEAVES: numerous, 10-30 cm long

INFLORESCENCE: panicle narrow, 6-20 cm long; branches erect; spikelets 3 to 6-flowered; lemmas without a basal web

HABITAT: widely distributed from grassland to open dry forest, often where alkaline

SLIMSTEM REEDGRASS
Calamagrostis stricta

FORM: slender rhizomatous perennial, 30-60 cm tall

LEAVES: erect, stiff, 1.5-3.0 mm broad

INFLORESCENCE: panicle relatively congested, rarely over 2 cm broad; single floret to the spikelet; callus hairs 1/2-3/4 as long as lemma; slender awn attached to back of lemma

HABITAT: scattered in fens and marshes

NOTES: synonym C. neglecta

SCRIBNER'S REEDGRASS
Calamagrostis scribneri

FORM: large, robust, rhizomatous, usually at least 1 m tall

LEAVES: numerous, elongate, rather lax, to 10 mm wide

INFLORESCENCE: panicle large, usually over 2 cm broad; spikelet with single floret; callus hairs nearly as long as lemma ; slender awn attached to back of lemma; glumes 3.8-4.5 mm long

HABITAT: common in fens, marshes and swamps

NOTES: C. canadensis is very similar but has smaller glumes 3-3.5 mm long, and has a tendency towards a more open panicle

SLOUGHGRASS
Beckmannia syzigachne

FORM: tall, rather stout annual up to 1 m high

LEAVES: flat, 5-10 mm broad

INFLORESCENCE: congested, up to 30 cm long, composed of several 1-sided spikes; glumes inflated, semi-circular

HABITAT: widespread in wet meadows, marshes and fens

NOTES: palatable to livestock

LITTLE MEADOW-FOXTAIL
Alopecurus aequalis

FORM: erect or spreading, stems 15-60 cm tall, often with a curved base underwater

LEAVES: flat, 1-4 mm wide, lax when submerged

INFLORESCENCE: slender, spike-like panicle, 2-7 cm long, pale green; lemma with short awn attacked near middle

HABITAT: wet places, often submerged

SHORE SEDGE
Carex limosa

FORM: stems single or few on long slender rhizomes; roots covered with a yellowish felt

LEAVES: few on lower part of stem

SPIKES: terminal male spike long, 15-27 mm; female spikes nodding; broad obtuse scales equaling length of perigynia

HABITAT: common in fens

SLENDER SEDGE
Carex lasiocarpa

FORM: tall (up to 120 cm), slender with scaly rhizome

LEAVES: rolled, narrow, less than 2 mm wide

SPIKES: terminal spike male; female spikes 1 or 2, sessile; lower bract long; perigynia densely pubescent with erect teeth (a)

HABITAT: common in fens; also edges of streams and lakes; frequently forms pure stands

PARRY'S SEDGE
Carex parryana

FORM: stem usually solitary, stiff, much exceeding the leaves

LEAVES: clustered near the base, flat and firm; old leaves conspicuous

SPIKES: 3-5, erect, linear, the terminal one male or partly male, the other spikes female; perigynia closely appressed

HABITAT: infrequent in alkaline meadows and shrub-carrs; also found along lake margins

FIELD SEDGE
Carex praegracilis

FORM: stems arising singly from stout black creeping rhizome; old sheaths dark like the rhizome

LEAVES: shorter than stems

SPIKES: sessile, closely aggregated; male flowers above female or plant often dioecious; perigynia 2.6-4.5 mm long with prominent beak (a)

HABITAT: common in moist alkaline soil of meadows, often moving into adjoining grassland

BEAKED SEDGE
Carex rostrata

FORM: stout stems in clumps from long scaly rhizomes

LEAVES: yellow-green, elongate, smooth; sheath intact (a)

SPIKES: cylindrical with terminal spikes male, female spikes below; perigynia inflated with long beak, (b)

HABITAT: common in marshes, fens and swamps, often in pure stands

NOTES: readily grazed; a common component of wetland hay

AWNED SEDGE
Carex atherodes

FORM: stout stems in clumps from long scaly rhizomes

LEAVES: pubescent, the short hairs visible to the unaided eye; sheath pubescent, breaking, becoming conspicuously filamentose (a)

SPIKES: cylindrical with terminal spikes male, female spikes below; perigynia inflated, narrowing gradually to the base of two long teeth, (b)

HABITAT: common in marshes and fens, sometimes in pure stands

NOTES: readily grazed

WATER SEDGE
Carex aquatilis

FORM: stout stems in clumps from long scaly rhizomes

LEAVES: glaucous green, elongate and smooth; sheath red, intact (a)

SPIKES: cylindrical with terminal spikes male, female spikes below; perigynia flattened, ovate, green, (b)

HABITAT: common in marshes, fens and swamps, usually mixed with C. rostrata

NOTES: readily grazed; a common component of wetland hay

LESSER PANICLED SEDGE
Carex diandra

FORM: stems clustered, forming a loose tussock 30-70 cm high, exceeding the leaves

LEAVES: narrow; sheaths thin, conspicuously speckled with red dots, not copper-tinged at the mouth (a)

SPIKES: several, closely aggregated into a dense brown head; male flowers at the top of each spike; perigynia dark, shiny, longer than scales,(b)

HABITAT: a very common sedge of fens and marshes

SARTWELL'S SEDGE
Carex sartwellii

FORM: tall, 50-80 cm high, arising singly or in small clumps from a dark brown rhizome; leaves widely separated; ventral strip of leaf sheath with green lines (a)

SPIKES: numerous (10-20) aggregated into a stout head 3-6 cm long; spikes with male flowers above female; perigynia hidden by scales, 3-4 mm long (b)

HABITAT: common in marshes, fens and swamps; often in alkali areas

ARCTIC RUSH
Juncus arcticus

FORM: numerous slender, stiff, wiry stems, 20-80 cm tall, from a stout, scaly rhizome

LEAVES: all basal, reduced to sheaths

INFLORESCENCE: clustered on the side of the stem with a long bract (5-20 cm) seemingly a continuation of the stem

HABITAT: common in saline meadows; also occurs in shrub-carrs, fens and marshes

NOTES: synonym J. balticus

NEVADA BULRUSH
Scirpus nevadensis

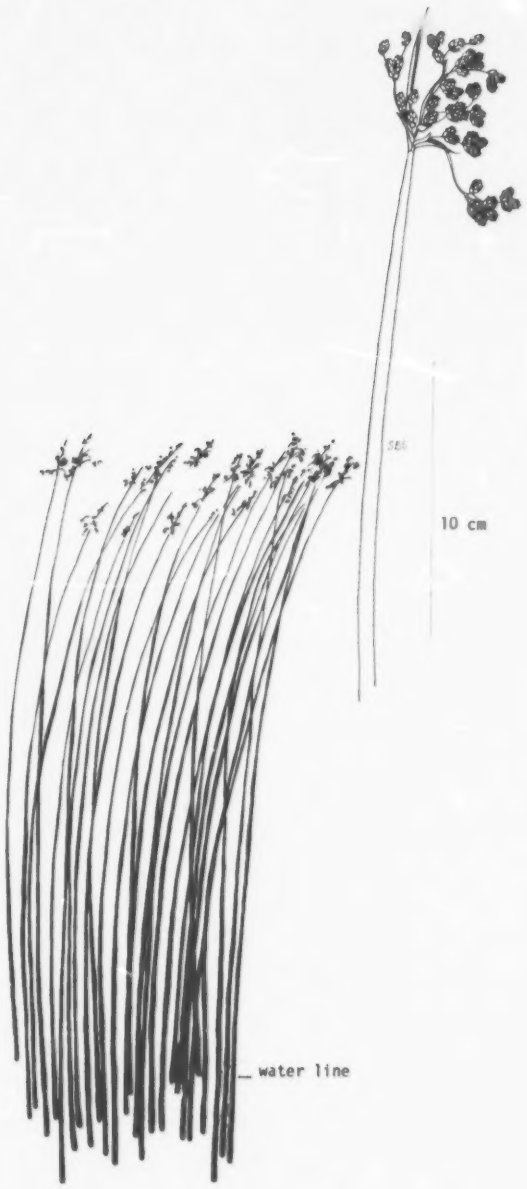
FORM: vigorously rhizomatous perennial; stems tough and wiry, 10-40 cm tall

LEAVES: firm, clustered near the base

INFLORESCENCE: usually 3 (1-10) spikelets, sessile in a compact cluster, subtended by a slender green bract; achene without a projecting point at the top (a)

HABITAT: common in saline meadows

OTHER GRASS-LIKE PLANTS



GREAT BULRUSH
Scirpus lacustris

FORM: stout rhizomatous perennial 1-3 m tall; stems round and firm

LEAVES: few at base of stem or none

INFLORESCENCE: open or compact panicle subtended by a bract resembling a continuation of the stem; spikelets numerous, in small clusters

HABITAT: forms dense colonies in marshes and along lake edges in water up to 1 m deep

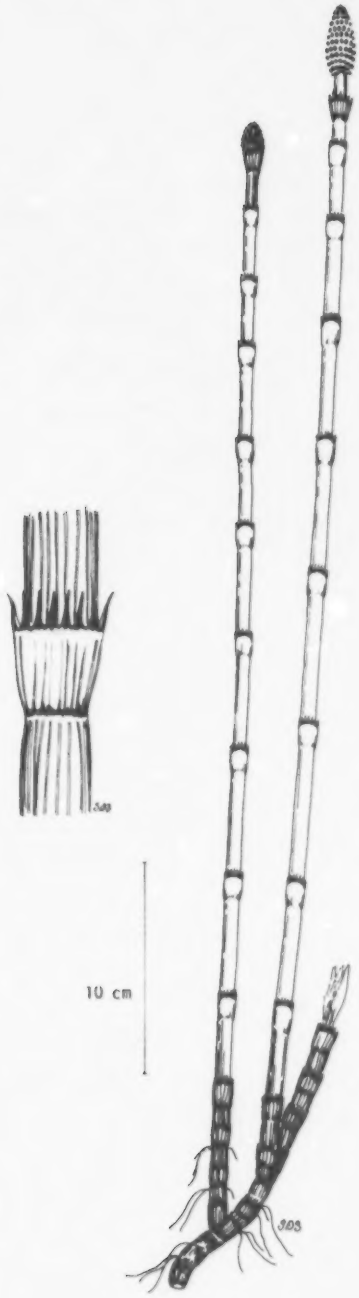
CATTAIL
Typha latifolia

FORM: stout perennial 1-3 m tall, with extensive creeping roots

LEAVES: long and flat, mostly 8-20 mm broad

INFLORESCENCE: terminal, cylindrical, with male portion above and continuous with female portion

HABITAT: forms extensive dense colonies in shallow-water marshes



SWAMP HORSETAIL
Equisetum fluviatile

FORM: stems annual, green, all alike, usually unbranched but occasionally with whorls of short branches

SHEATHS: green with persistent fine dark brown teeth

CONES: borne at the tip of main stem, long-stalked, deciduous

HABITAT: often occur in numbers in shallow water; common in marshes and fens

MARES-TAIL
Hippuris vulgaris

FORM: perennial with creeping rhizome; the erect stem usually partially emersed in water

LEAVES: linear, sessile, entire, in whorls of 6-12, 1-2 mm wide

FLOWERS: small, sessile, in axils of leaves of upper whorls

HABITAT: common in marshes and fens

SEASIDE ARROWGRASS
Triglochin maritimum

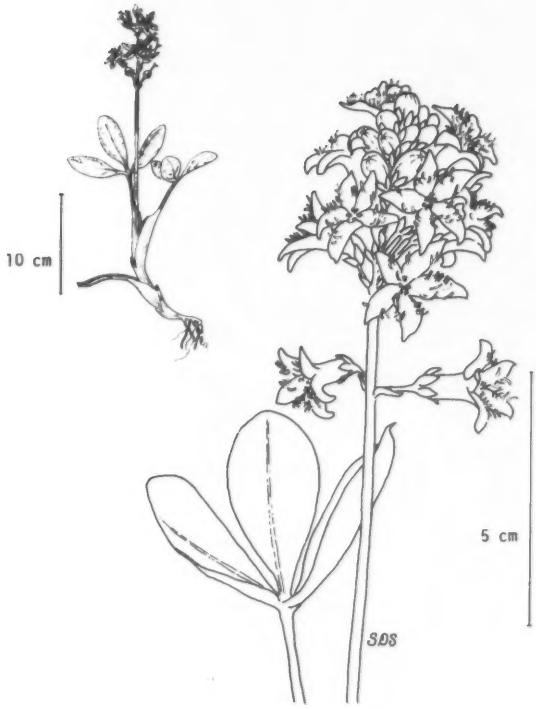
FORM: semi-aquatic, tufted perennial with thick rhizome; flowering stems 30-50 cm tall

LEAVES: basal, linear, somewhat fleshy and blunt

FLOWERS: small, greenish, arranged in an elongated spike-like raceme

HABITAT: common in saline meadows and marshes; also found in fens

NOTES: seaside arrowgrass is poisonous due to the presence of cyanide in the plant. Plants are most toxic in the spring once the new growth has appeared or after a frost during the growing season



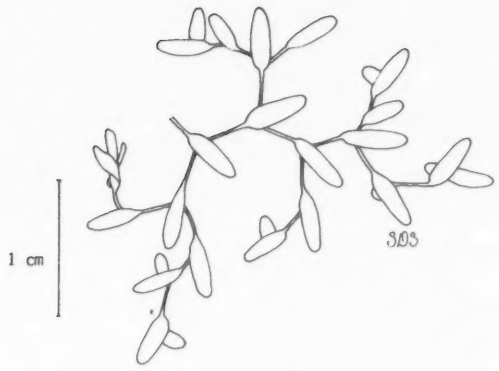
BUCKBEAN
Menyanthes trifoliata

FORM: coarse perennial with thick rhizome

LEAVES: each with three leaflets on a long petiole from a large basal sheath

FLOWERS: a dense cluster of whitish, often purplish-tinged, flowers; hairs on petals give a fringed appearance; stamens maybe longer or shorter than pistil

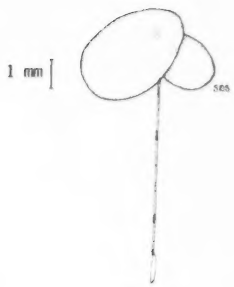
HABITAT: common in fens, bogs and along the edges of some shallow ponds or lakes

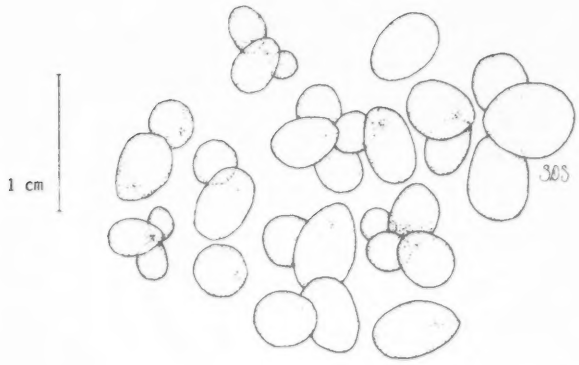


IVY-LEAVED DUCKWEED
Lemna trisulca

FORM: small oblong or lanceolate fronds tapering to a narrow stalk up to 13 mm long overall

HABITAT: commonly seen in still or slowly moving water, forming loose colonies just below the surface, or forming extensive mats at the bottom of shallow water

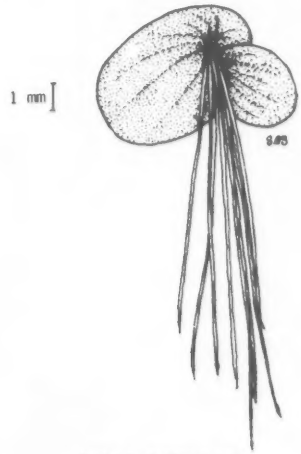




LESSER DUCKWEED
Lemna minor

FORM: small, free-floating aquatic with disk-like, leafy fronds 2-5 mm long; single root dangles from the lower surface of each frond

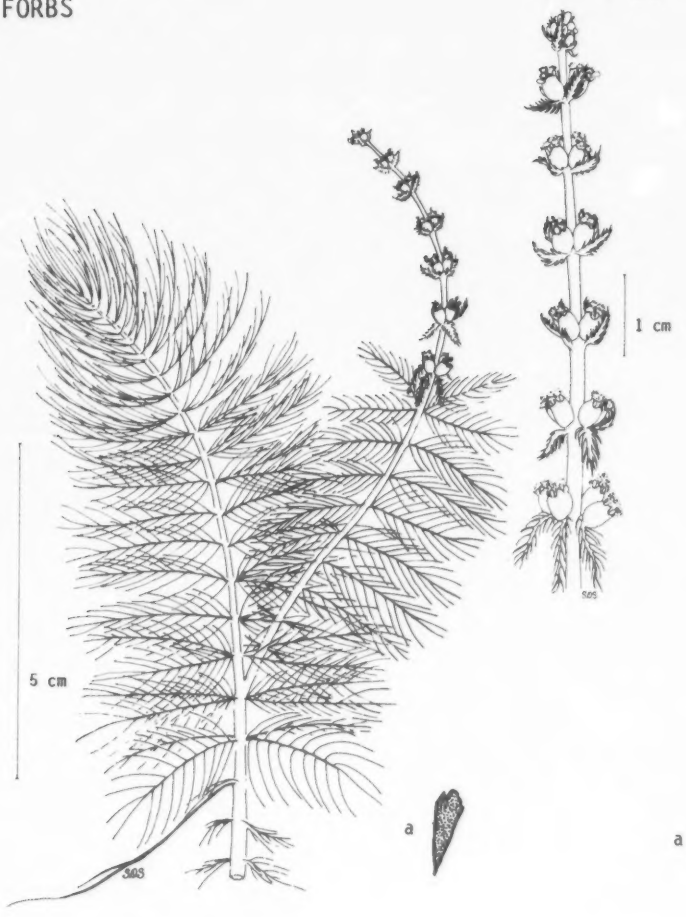
HABITAT: found in large quantities on the surface of still water



GREAT DUCKWEED
Spirodela polyrhiza

FORM: resembles a large Lemna minor plant; 4-8 mm long, dark purplish beneath with 7-15 rootlets in a central tuft

HABITAT: small groups common in marshes mixed with Lemna minor, where it may be distinguished by its conspicuously larger size



WHORLED WATER-MILFOIL
Myriophyllum verticillatum

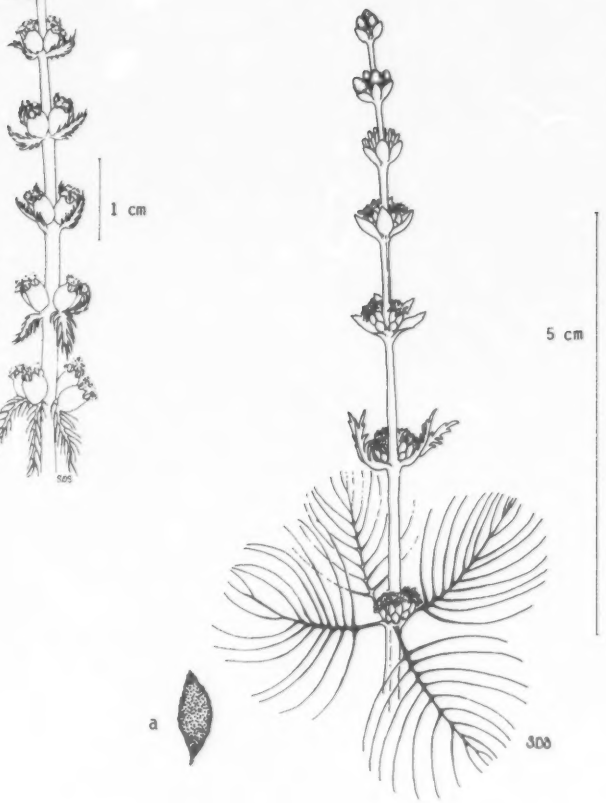
FORM: submersed aquatic perennial with branched stems; overwintering buds present as club-shaped, thickened, dark yellow-green leaf tips (a)

LEAVES: pectinately divided, in whorls of 3 or 4, the divisions filiform in 6-11 pairs

FLOWERS: very small, sessile, in whorls of 4, on a terminal emergent spike; bracts deeply incised; lower bracts usually more than twice as long as flowers

HABITAT: common in shallow open water, and in fens and marshes with permanent standing water

NOTES: M. exalbescens, another native species, is similar but has undivided bracts of the upper inflorescence



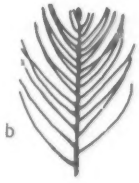
NORTHERN SPIKED WATER-MILFOIL
Myriophyllum exalbescens

FORM: submersed aquatic perennial with stems that tend to branch only in the lower third of the plant; early in the season the tips of the growing stems are very compact, often with a tight, usually yellowish-green knob; overwintering buds present as thickened, black-green tips that taper to a point (a)

LEAVES: in whorls of 3 or 4, with less than 28 narrow divisions on each leaf

FLOWERS: very small, sessile, in whorls of 4, on a terminal emergent spike; bracts entire, lower bracts short

HABITAT: common in shallow open water, and in fens and marshes with permanent standing water



NOTES: Eurasian water-milfoil (M. spicatum), a weedy introduced species, is closely related but has very different growth strategies. Stems of this species usually grow without branching until they are near the water surface where they branch profusely. The tips of the growing stems are commonly red; the more numerous narrow leaf divisions (more than 28) give the leaves a feather-like appearance (b); there are no thickened overwintering buds

GREATER BLADDERWORT
Utricularia vulgaris

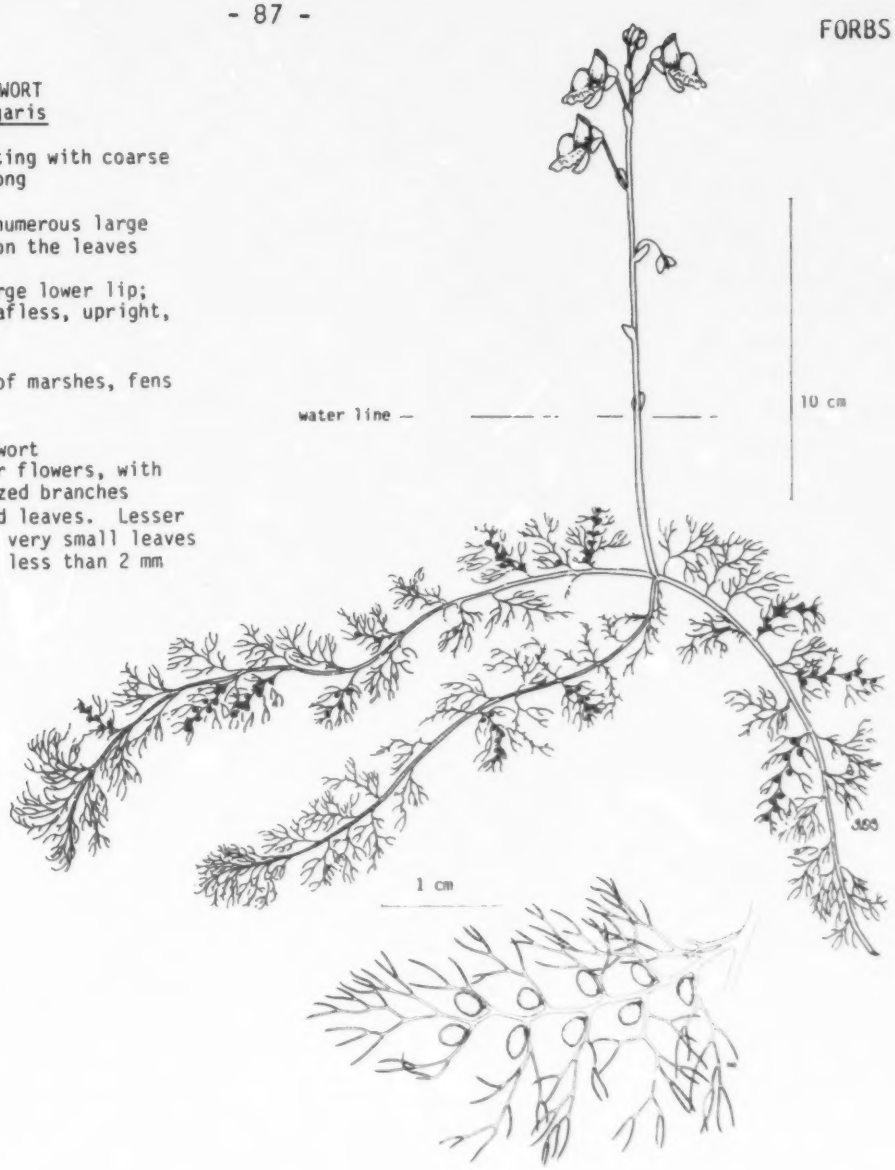
FORM: submersed, free-floating with coarse branched stems up to 1 m long

LEAVES: finely dissected; numerous large colourless bladders borne on the leaves

FLOWERS: yellow, with a large lower lip; several at the end of a leafless, upright, emergent stem

HABITAT: a common aquatic of marshes, fens and shallow open water

NOTES: flat-leaved bladderwort (U. intermedia) has smaller flowers, with bladders borne on specialized branches distinct from the dissected leaves. Lesser bladderwort (U. minor) has very small leaves and flowers, with bladders less than 2 mm wide, borne on the leaves.



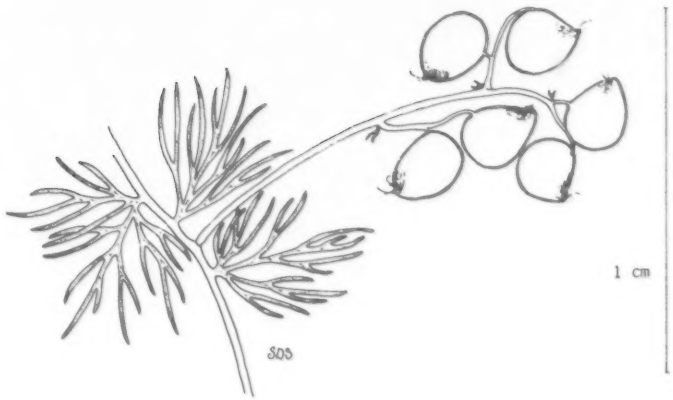
FLAT-LEAVED BLADDERWORT
Utricularia intermedia

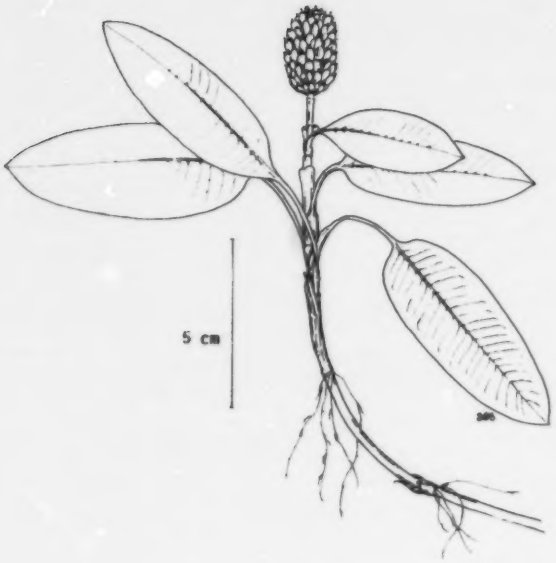
FORM: submersed aquatic with very slender stems, commonly creeping along the bottom; small bladders borne on specialized branches without leaves

LEAVES: very finely dissected into thread-like segments

FLOWERS: yellow, with a large lower lip; several at the end of a leafless, upright, emergent stem

HABITAT: a common aquatic of marshes, fens and shallow open water





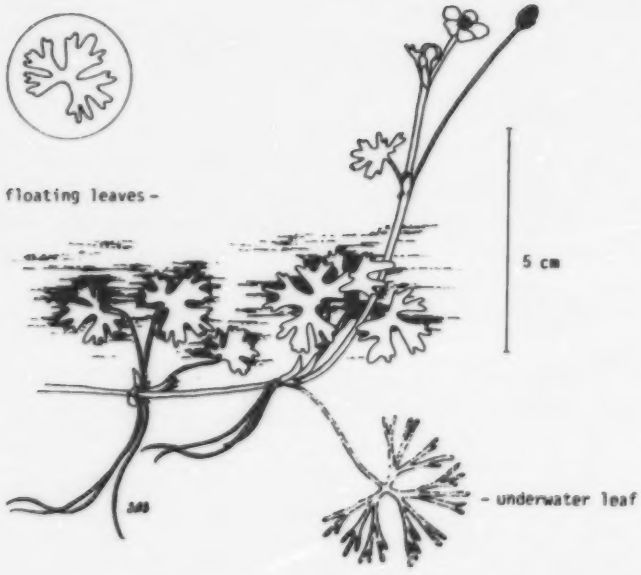
WATER SMARTWEED
Polygonum amphibium

FORM: aquatic to amphibious perennial; stems prostrate and freely rooting; flowering branches erect

LEAVES: narrowly elliptic, usually floating, long-petioled and somewhat leathery

FLOWERS: pink in a cylindric spike, rarely over 3 cm long

HABITAT: common in meadows, fens and marshes



SMALL YELLOW WATER-BUTTERCUP
Ranunculus gmelinii

FORM: semi-aquatic perennial with floating branched stems, freely rooting at the nodes

LEAVES: emergent leaves floating, 1-2 cm long, deeply lobed, cordate at base; submerged leaves finely dissected

FLOWERS: emergent on slender stems; petals 5, yellow, 3-7 mm long

HABITAT: common in marshes and fens

NOTES: R. aquatilis and R. amphibius are similar with finely dissected leaves, but have white petals. R. aquatilis collapses when taken from water.

SHORE BUTTERCUP
Ranunculus cymbalaria

FORM: low perennial with runners and predominantly basal leaves on thin stalks

LEAVES: small, rounded with cordate bases and wavy margins

FLOWERS: small, 5-8 mm across, yellow, with a conical centre

HABITAT: common in meadows and at the edge of marshes

SMALL BEDSTRAW
Galium trifidum

FORM: perennial with numerous stems from very slender, creeping rhizomes; stems weak and lax, tending to scramble on other vegetation

LEAVES: usually 4 (5 or 6) in a whorl, narrowly elliptic, blunt

FLOWERS: small, whitish, 1-3 at the end of slender stalks arising from leaf axils or at the tip of branches

FRUIT: smooth, spherical, often in pairs

HABITAT: occurs in fens and swamps, often under other vegetation

SEABLITE
Suaeda depressa

FORM: a freely branched, erect or spreading annual

LEAVES: linear, rather fleshy, dark green

FLOWERS: small, clustered in the axils of upper leaves

HABITAT: common in saline meadows

MARSH CINQUEFOIL
Potentilla palustris

FORM: stems decumbent, reddish, with long creeping rootstocks

LEAVES: lower leaves long-stalked, with 5-7 coarsely toothed leaflets; upper leaves smaller

FLOWERS: conspicuous, purplish; the sepals much longer than the petals

HABITATS: occurs in fens, bogs and marshes, often partially submerged

SILVERWEED
Potentilla anserina

FORM: perennial with long, many-jointed runners

LEAVES: all basal, spreading, pinnate; leaflets sharply toothed, silvery on under-surface

FLOWERS: yellow, on peduncles up to 10 cm tall

HABITAT: common in meadows and shrub-carrs; also along the margins of streams and ponds

STAR-FLOWERED SOLOMON'S SEAL
Smilacina stellata

FORM: stems slightly flexuous from a stout rhizome

LEAVES: sessile, alternate and lance-shaped

FLOWERS: creamy white in a few-flowered raceme

HABITAT: common in shrub-carrs, shrubby fens and in swamps

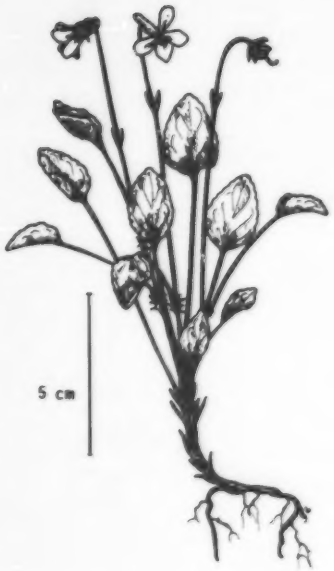
PINK WINTERGREEN
Pyrola asarifolia

FORM: rhizomatous perennial with a single flowering stem up to 40 cm tall

LEAVES: basal, circular to elliptic, rounded at base, shiny dark green on top, purplish beneath; petiole as long as the blade

FLOWERS: 10-25 in a long loose cluster, petals pinkish to purplish-red; style long, bent to one side

HABITAT: found in shrubby fens and in swamps



EARLY BLUE VIOLET
Viola adunca

FORM: tufted, aerial stems leafy

LEAVES: orbicular to heart-shaped; margins finely round-toothed

FLOWERS: blue to deep violet, the lower three petals with purple lines on a white base; style with bearded head

HABITAT: common in shrub-carrs and meadows

YARROW
Achillea millefolium

FORM: aromatic perennial with single or clustered stems

LEAVES: finely divided, soft, only the lower ones on stalks

FLOWERS: numerous heads in a flat to round-topped cluster; each head with 3-5 white ray flowers and numerous yellow disk flowers

HABITAT: widespread; always present in shrub-carrs; increases with disturbance

FRINGED ASTER
Aster ciliolatus

FORM: stem erect, up to 70 cm tall, with long creeping rhizomes; often present in leaf stage only

LEAVES: smooth, lance-shaped, rounded or heart-shaped at base; basal and lower stem leaves with long stalks that have firm hairs on the edges

FLOWERS: few to many blue flower heads

HABITAT: widespread; common in shrub-carrs

RUSH ASTER
Aster borealis

FORM: slender perennial from creeping rhizome seldom over 2 mm thick; stem smooth below, with lines of small hairs above

LEAVES: sessile, linear; basal leaves withered by flowering time

FLOWERS: one to many at end of stem or branches, white or pale bluish

HABITAT: scattered in meadows, fens and swamps, often on hummocks

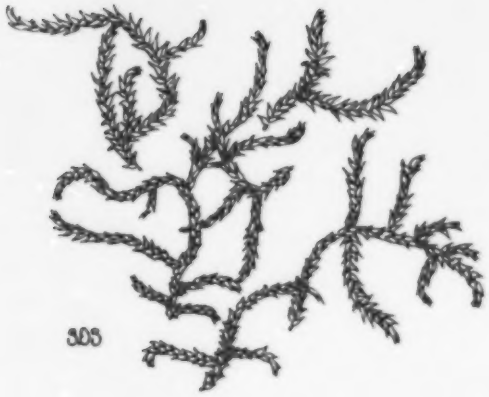
TUFTED WHITE PRAIRIE ASTER
Aster pansus

FORM: one to several clustered stems from an erect rootstock

LEAVES: small, narrow and very numerous

FLOWERS: white, small and numerous, on spreading branches

HABITAT: common in saline meadows and shrub-carrs

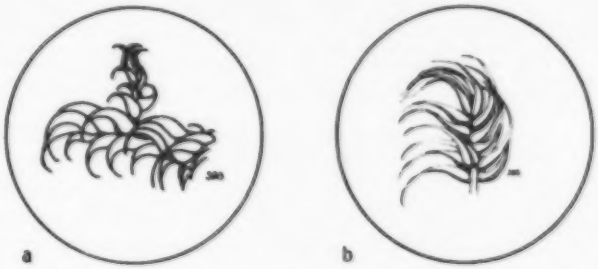


Brachythecium spp.

FORM: moss small, mat forming, often more or less shiny; stems creeping, freely branched; leaves ovate to lanceolate, often folded lengthwise

HABITAT: widespread on soil in all classes of wetlands, occasionally underwater

NOTES: individual species difficult to distinguish



Drepanocladus aduncus

FORM: moss forms loose or dense, yellow-green or brownish mats; leaves are fine, curved like a sickle and turned to one side of the stem (a)

HABITAT: common in marshes, fens and swamps; frequently submerged in shallow water

NOTES: a similar species D. crassicostatus has leaves with a stout midrib (b)

Aulacomnium palustre

FORM: fairly robust moss, forming tufts of erect plants; new growth on tips is light green contrasting with the brownish-red of old growth below

HABITAT: widespread in shrubby fens, swamps and bogs

Mnium spp.

FORM: moss forms loose or dense tufts; single stem has broad, pale green, translucent leaves; lower part of stem is fibrous matted

HABITAT: occasional in swamps and shrubby fens

Tomenthypnum nitens

FORM: moss forms dense mats that are light green to yellow-green and golden; short single branches come off main stem

HABITAT: widespread in fens, swamps and bogs

Sphagnum cappillaceum

FORM: moss compact, often forming deep hummocks, green or more often red or red-tinged, not shiny; stems erect with lateral branches in conspicuous clusters of 3-5

HABITAT: common in bogs, and in fens that are transitional to bogs

NOTES: a similar species S. fuscum has a brown colour and forms a compact growth at the top of hummocks

APPENDIX 2 Glossary of technical terms used in plant descriptions

Achene - small, dry, hard, one-seeded fruit that remains persistently closed.

Amphibious - living both on land and in water.

Awn - a slender bristle.

Axil - the angle between a leaf and a stem.

Beak - a hard point or projection.

Bract - a modified leaf in whose axil a flower arises.

Callus - the thickened base of the lemma in many grasses.

Capsule - dry fruit that splits open to release many seeds.

Cordate - heart-shaped.

Deciduous - falling after completion of the normal function.

Decumbent - curved upward from a horizontal or inclined base.

Dioecious - producing male and female flowers on separate individuals.

Filamentose - composed of, or breaking up into, threads.

Floret - an individual flower of a definite cluster, as in the spikelet of a grass.

Incised - rather deeply and sharply cut.

Internode - the part of a stem between two adjacent nodes.

Lemma - the bracts that subtend the individual flower in grass spikelets.

Ligule - the thin appendage on the inside of a leaf at the junction of sheath and blade.

Panicle - an inflorescence with a main axis and subdivided branches.

Pectinate - comb-like.

Peduncle - the stalk of an inflorescnece or of a flower.

Perigynium - the inflated, sac-like organ surrounding the ovary or achene in Carex.

Petiole - a leaf stalk.

Pinnate - with two rows of lateral branches like the barbs on a feather.

Pistil - the female organ of a flower.

Pubescent - bearing hairs of any sort.

Raceme - an inflorescence in which the spikelets are pediceled on a rachis.

Rhizome - a creeping underground stem.

Scabrous - rough to the touch due to the presence of short, stiff hairs.

Sessile - attached directly by the base without a stalk.

Sheath - the lower part of a leaf that encloses the stem.

Spike - an unbranched inflorescence.

Stamen - the part of the flower that bears the pollen.

Stipules - a pair of basal appendages found on many leaves.

Striate - marked with fine, more or less parallel lines.

Style - the slender stalk that connects the stigma to the ovary.

Web - the cluster of soft hairs at the base of the lemma in certain species of Poa.

APPENDIX 3. References for botanical descriptions of wetland plant species of the IDFb2.

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